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Phase Behavior in Binary and Multicomponent Systems At Elevated Pressures: *n*-Pentane and Methane-*n*-Pentane

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Foreword

The National Standard Reference Data System provides effective access to the quantitative data of physical science, critically evaluated and compiled for convenience, and readily accessible through a variety of distribution channels. The System was established in 1963 by action of the President's Office of Science and Technology and the Federal Council for Science and Technology, with responsibility to administer it assigned to the National Bureau of Standards.

The System now comprises a complex of data centers and other activities, carried on in academic institutions and other laboratories both in and out of government. The independent operational status of existing critical data projects is maintained and encouraged. Data centers that are components of the NSRDS produce compilations of critically evaluated data, critical reviews of the state of quantitative knowledge in specialized areas, and computations of useful functions derived from standard reference data. In addition, the centers and projects establish criteria for evaluation and compilation of data and make recommendations on needed improvements in experimental techniques. They are normally closely associated with active research in the relevant field.

The technical scope of the NSRDS is indicated by the principal categories of data compilation projects now active or being planned: nuclear properties, atomic and molecular properties, solid state properties, thermodynamic and transport properties, chemical kinetics, and colloid and surface properties.

The NSRDS receives advice and planning assistance from the National Research Council of the National Academy of Sciences-National Academy of Engineering. An overall Review Committee considers the program as a whole and makes recommendations on policy, long-term planning, and international collaboration. Advisory Panels, each concerned with a single technical area, meet regularly to examine major portions of the program, assign relative priorities, and identify specific key problems in need of further attention. For selected specific topics, the Advisory Panels sponsor subpanels which make detailed studies of users' needs, the present state of knowledge, and existing data resources as a basis for recommending one or more data compilation activities. This assembly of advisory services contributes greatly to the guidance of NSRDS activities.

The NSRDS–NBS series of publications is intended primarily to include evaluated reference data and critical reviews of long-term interest to the scientific and technical community.

LEWIS M. BRANSCOMB, *Director*

Preface

In 1966 support was received from the Office of Standard Reference Data of the National Bureau of Standards for a program of data review undertaken in the Chemical Engineering Laboratory of the California Institute of Technology. Emphasis was directed to the volumetric and phase behavior of the coexisting phases of pure paraffin hydrocarbons and their binary mixtures. An effort was made to provide conservative estimates of the accuracy in contradistinction to the precision of the tabulations presented. As a result of the withdrawal of B. H. Sage from active research on July 1, 1969, the program has been limited to work completed at that time. The current presentation covers a review of the methods employed, the volumetric and phase behavior of *n*-pentane, and the volumetric and phase behavior in the methane-*n*-pentane system.

A number of the members of the staff of the Chemical Engineering Laboratory contributed to the work and among these should be mentioned Donna Johnson, who aided in the tabulation of the results and the preparation of the manuscript, and June Gray, who assisted the authors in the preparation of the numerous diagrams associated with this activity.

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Nomenclature

A, B, C, D	*Coefficients*
G	Variable
K	Molal equilibrium ratio, $K = y/x$
N	Number of points
P	Pressure, atm or psia
$\underset{\sim}{P}$	Residual pressure, atm or psia
s	Average deviation defined by $\sum_{1}^{N} (G_{exp} - G_{sm})/N$
s'	Absolute deviation defined by $\sum_{1}^{N} (G_{exp} - G_{sm})/N$
T	Absolute temperature, K or °R
t	Temperature, °C or °F
V	Specific volume, liters/kg or ft³/lb
V	Molal volume, liters/kg-mol or ft³/lb-mol
$\underset{\sim}{V}$	Residual volume, liters/kg
x	Mole fraction liquid
y	Mole fraction gas
α	Degrees of freedom
σ	Standard error of estimate $\left\{\left[\sum_{1}^{N} (G_{exp} - G_{sm})^2\right]/(N-\alpha)\right\}^{1/2}$

Subscripts

exp	Experimental
gr	Graphical
k	Component k
j	Component j
r	Reference
sm	Smooth or predicted

Constants and Conversion Factors

Molecular Weight[a]

Methane	16.04303
Propane	44.09721
n-Pentane	72.15139

Physical Constants[b]

Force
1 pound (lb) avoirdupois = 453.59237 grams (g)

Length
1 U.S. inch (in) = 2.54 centimeters (cm)

Volume
1 liter (l) = 1000 cm³

Acceleration Due to Gravity—Standard
g_c = 980.665 cm/sec²
= 32.1740 ft/sec²

Pressure
1 standard atmosphere (atm) = 1,013,250 dyne/cm² = 101,325 N/m²

Temperature
1 degree centigrade (° C) = 1.8 degrees Fahrenheit (° F)
T_0° C = 273.16 degrees Kelvin (° K)
T_0° F = 459.688 degrees Rankine (° R)

[a] Based on a Report of the International Commission on Atomic Weights, J. Am Chem. Soc. **84**, 4175–97 (1962).
[b] Wilhoit, Randolph C. and Hathaway, Wayne, Tables of Conversion Factors Based on Accepted Constants as of 1965. Am Petroleum Inst., Project 44, Chemical Thermodynamic Properties Center, Texas A & M Univ., College Station, Texas, Nov. 1965.

Conversion Factors[a]

Length

Units	cm	m	in	ft
1 cm	1	0.01	0.3937008	0.0328040
1 m	100	1	39.37008	3.280840
1 in	2.540000	0.02540000	1	0.08333333
1 ft	30.48000	0.3048000	12.0000	1

Area

Units	cm^2	m^2	in^2	ft^2
1 cm^2	1	10^{-4}	0.1550003	1.076391×10^{-3}
1 m^2	104	1	1550.0003	10.76391
1 in^2	6.451600	6.451600×10^{-4}	1	6.944444×10^{-3}
1 ft^2	929.0304	0.09290304	144.0000	1

Volume

Units	cm^3	in^3	ft^3	liter
1 cm^3	1	0.06102374	3.531467×10^{-5}	1.000×10^{-3}
1 in^3	16.38706	1	5.787037×10^{-4}	1.638661×10^{-2}
1 ft^3	28316.85	1728.000	1	28.31685
1 liter	1000.000	61.02375	0.0351467	1

Weight

Units	g	lb
1 g	1	2.204623×10^{-3}
1 lb	453.5924	1

Specific Weight

Units	g/cm^3	g/ml	lb/ft^3
1 g/cm^3	1	1	62.42795
1 g/ml	1	1	62.42795
1 lb/ft^3	0.01601847	0.01601847	1

Pressure

Units	atm	kg/cm^2	lb/in^2	$Newton/m^2$
1 atm	1	1.033227	14.69595	1.013250×10^5
1 kg/cm^2	0.9678411	1	14.22334	9806.650
1 lb/in^2	0.06804596	0.07030696	1	6894.757
$Newtons/m^2$	9.869233×10^{-6}	1.019716×10^{-5}	14.50377×10^{-5}	1

[a] See footnote [b] on page VII.

Phase Behavior in Binary and Multicomponent Systems At Elevated Pressures: *n*-Pentane and Methane-*n*-Pentane

Virginia M. Berry and B. H. Sage

This paper, which is concerned with the critical evaluation of data on the phase behavior of binary systems, consists of three parts. In the first part the rationale of the evaluation process used is discussed, in the second the behavior of n-pentane, and in the third the behavior of the system methane-n-pentane.

The properties of n-pentane considered are the critical constants and the vapor pressures and densities of the saturated coexistent phases as functions of temperature. For the methane-n-pentane system the compositions and densities of the coexisting phases are given as functions of temperature and total pressure. Data for the unique states of the two-component system are also presented.

Discussions are given of the reliability of the selected values and of the differences between the selected values and various measured values.

Key words: Evaluated data; liquid-vapor equilibria; methane-n-pentane system; n-pentane; thermodynamics.

1. Introduction

The critical review of experimental data in the field of volumetric and phase behavior of pure substances and mixtures involves, at best, certain elements of judgment, particularly in regard to the actual in contradistinction to the stated uncertainties of measurement. Probably historical evidence is the best evidence of the difference between the stated and actual uncertainties associated with experimental observations. Often precision is confused with accuracy even though the author has made a conscientious effort to appraise the uncertainties in each of the primary experimental variables involved. In this critical review and compilation, an effort was made to apply realistic and conservative uncertainties to the tabulated values which, to many readers, may seem unusually large when the claims of the investigators are considered.

In the authors' experience, the accepted intensive properties of materials continue to change with the passage of time by amounts which are many times the original estimated uncertainties involved in the experimental work. An example of such a situation is the thermodynamic properties of water. Accurate values of the thermodynamic properties of water in both the liquid and gas phase are of importance in the design of large steam turbines. Yet, within the last 10 years, differences in the properties of water employed in this country and in Russia resulted in significant differences in the prediction of the efficiency of large steam turbines manufactured in the two countries. Even with unusual international cooperation in this matter [1][1] individual nations still prepare their own tabulations of the thermodynamic properties of water which differ somewhat in detail.

On the basis of such experience it is hoped that the reader will understand the conservatism employed in assigning rather large measures of uncertainty to the individual experimental data as compared to that which has often been suggested by the original experimental investigator. In addition, the uncertainties assigned to the recorded values have been set forth on what is hoped to be a realistic basis. It will remain for investigators of the future to ascertain whether the somewhat subjective assignment of uncertainty in connection with the recorded values has been correct.

1.1. Measures of Uncertainty

In the following section a short discussion of the measures of uncertainty employed is presented. No attempt has been made to justify the choice of such measures but only to indicate in a specific manner what was involved. The use of an example is perhaps the best method to illustrate the fashion in which the several measures of uncertainty can be applied. In figure 1.1 [2] is portrayed the variation in the specific volume with temperature of the dew point gas for propane. In addition, the various experimental values upon which the critically chosen line was evaluated have been presented. There is set forth in table 1.1 the several results obtained by different experimental methods. The points shown in figure 1.1 are presented in the table together with

[1] Figures in brackets indicate the literature references at the end of this paper.

[2] Figures and tables will be found at the end of the section to which they pertain.

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an estimate of the measure of uncertainty of each set of experimental data.

In the example, presented in table 1.1, it has been assumed that all of the uncertainty is in the specific volume and none in the temperature. The curve was established by direct graphical inspection of the data coupled with the application of "least squares" methods of analysis to a particular polynomial which will be presented later in the discussion.

The greatest weight was given to the experimental data which was assigned the smallest uncertainty in table 1.1. Usually there is not as much experimental data as is indicated in figure 1.1 and the choice of the smooth functional relation becomes, in part, a matter of judgment. The average deviation with regard and without regard to sign was established by use of the following expressions:

$$s=\sum_{1}^{N}(G-G_{\mathrm{sm}})/N, \tag{1.1}$$

$$s'=\sum_{1}^{N}|G-G_{\mathrm{sm}}|/N. \tag{1.2}$$

For the most part, the value of the average deviation with regard to sign should be small and deviate from zero primarily as a result of intentional bias in locating the critically chosen value in order to favor the more accurate data. This is illustrated by the values of the average deviation with regard to sign of the points shown in figure 1.1 which have been tabulated in table 1.1 for each of the several investigators.

As a second measure of uncertainty, the average deviation without regard to sign was established from eq (1.2) and is one useful measure of the variability of the data from the smooth curve shown. The results of applying eq (1.2) to the experimental information presented in figure 1.1 are also recorded in a portion of table 1.1. The average difference between deviations with regard to and without regard to sign is evident.

For many purposes, the standard error of estimate is a useful means of indicating the difference between a chosen continuous function such as the curve in figure 1.1 and the experimental points involved. This quantity may be defined by eq (1.3):

$$\sigma=\left\{\left[\sum_{1}^{N}(G-G_{\mathrm{sm}})^2\right]\Big/(N-\alpha)\right\}^{1/2} \tag{1.3}$$

The quantity α represents the degrees of freedom associated with the system. In the case of a pure substance it is one since the temperature fully establishes all of the intensive properties of the two coexisting phases. The values of the standard error of estimate as established from eq (1.3) for each of the experimental investigations are recorded in a portion of table 1.1.

All of these measures of uncertainty suffer from the fact that the magnitude of the dependent variable undergoes marked change from a low temperature to temperatures approaching that of the critical state. In some circumstances it is desirable to treat only portions of the range of the independent variables as an independent statistical population. This is particularly true when the data from different investigators do not extend over the entire range of the independent variable as is the case in figure 1.1. In many ways it would be advantageous to consider the normal distance of the curve from the experimental points in question. However, this introduces significant complexities in the evaluation of each measure of uncertainty and for that reason has not been adopted in the current tabulations.

1.2. Residual Methods

In many situations the combination of analytical and graphical techniques is useful. For example, it is possible to approximate the smooth curve shown in figure 1.1 by a polynomial of the following form:

$$V=AT+BT^2+CT^3+DT^4=24.967T-0.21184T^2 +0.60276\times10^{-3}T^3-0.57430\times10^{-6}T^4 \tag{1.4}$$

In this instance, the coefficients have been indicated in both symbolic and numerical form. There is shown in figure 1.2 the smooth curve of figure 1.1 and the graphical representation of eq (1.4). Upon a markedly enlarged scale the difference between the analytical and graphical representation has been depicted in a portion of figure 1.2. Such a difference is called the residual specific volume of the dew point which would be defined by:

$$\underset{\sim}{V}=V-V_{\mathrm{r}} \tag{1.5}$$

The value of the residual specific volume of the dew-point gas may be evaluated for each of the experimental points by application of eq (1.5). The corresponding values of the analytical reference values established from eq (1.4) for the temperature of measurement as well as the values of the residual specific volume of the dew-point gas are recorded in a part of table 1.2 for each set of experimental data. It is apparent from a review of table 1.2 that the residual specific volumes do not undergo changes in order of magnitude over the entire range of temperature.

Smooth values of the residual specific volume for each of the experimental points also are recorded in table 1.2. It is evident that the graphical precision realized by use of the residual techniques is much greater than that feasible from direct plotting of the data. Attempts to increase the scale of the graphical operations invariably results in such wide spacing of the experimental points as to render any marked improvement in the precision of the graphical operation difficult.

In table 1.3 are shown the values obtained for the average deviation with regard to sign, the

average deviation without regard to sign, and the standard error of estimate as determined from large plots, one such as is shown in figure 1.1 and a similar sized plot involving the residual data shown in figure 1.2. It is believed that the comparison presented in table 1.3 shows what can be gained by the use of residual methods.

Such approaches are also useful in connection with the smoothing of vapor pressure data. Under such circumstances a form of the Antoine equation [2] may be used as the reference expression for vapor pressure. The reference vapor pressure may be approximated by:

$$\log_{10} P_r = A + \frac{B}{T} \tag{1.6}$$

Using propane as an example, the coefficients of eq (1.6) become:

$$\log_{10} P_r = 4.294323 - \frac{990.5410}{T} \tag{1.7}$$

There is shown in table 1.4 experimental values of the vapor pressure of propane based upon the measurements of several investigators. The corresponding reference vapor pressure calculated from eq (1.7) is included along with the residual vapor pressure defined by eq (1.8):

$$P = P - P_r \tag{1.8}$$

In figure 1.3 is depicted the vapor pressure as a function of temperature for propane with the experimental data of table 1.4 included. In the lower part of this figure is shown the residual vapor pressure with the same experimental data. The shape of the residual vapor pressure curve is typical for most paraffin hydrocarbons when a form of the Antoine equation is employed as a reference. The precision with which the measures of uncertainty can be established has been increased manyfold by the use of the residual vapor pressure shown in the lower part of figure 1.3. The results of the evaluation by analytic methods of the average deviation with regard to sign, the average deviation without regard to sign, and the standard error of estimate are recorded in table 1.5 for each set of experimental data.

Such residual techniques as have been described were employed in this review and tabulation whenever feasible. A certain amount of ingenuity is required to utilize the most efficacious form of the analytical expression to approximate the experimental behavior. The use of residual methods prevents a tendency to expand the scale of both the independent and dependent variable in an attempt to increase the precision of the direct interpolative process. Often such attempts yield unsatisfactory results because of the wide spacing of the experimental data. This is illustrated in figure 1.4 where the vapor pressure data for propane have been expanded on a large scale plot involving only a portion of the temperature range. Physical separation of points on the diagram indicates the uncertainties that are introduced in arriving at the most probable curve to draw through the data.

1.3. Dimensions and Units [3]

The greater part of the scientific literature is expressed in the mass-length-time system of dimensions. This system of dimensions will be used throughout this compilation in the primary tabulations. However, in the interest of utility, pressures will be expressed in atmospheres. A conversion factor is available to permit the establishment of the numerical value of the pressure expressed in newtons per square meter if such should be desired. Temperatures will be expressed in degrees kelvin which are related to temperatures in degrees Celsius by the following expression:

$$T = t + 273.16 \tag{1.9}$$

The value of the constant in eq (1.9) is based upon recent international agreement concerning the temperature in degrees kelvin of the triple point of water [3]. The nomenclature employed together with the dimensions and units involved are given before the introduction on p. VII. A short table of conversion factors for the common dimensions and units used is also presented, p. VIII.

A number of secondary tabulations have been prepared involving the force-length-time system of dimensions and engineering units. The appropriate conversion factors may be found in the above-mentioned conversion table.

[3] The NBS Office of Standard Reference Data, as administrator of the National Standard Reference Data System, has officially adopted the use of SI units for all NSRDS publications, in accordance with NBS practice. This publication does not use SI units because contractual commitments with the author predate establishment of a firm policy on their use by NBS. However, conversion factors are given. We urge that specialists and other users of data in this field accustom themselves to SI units as rapidly as possible.

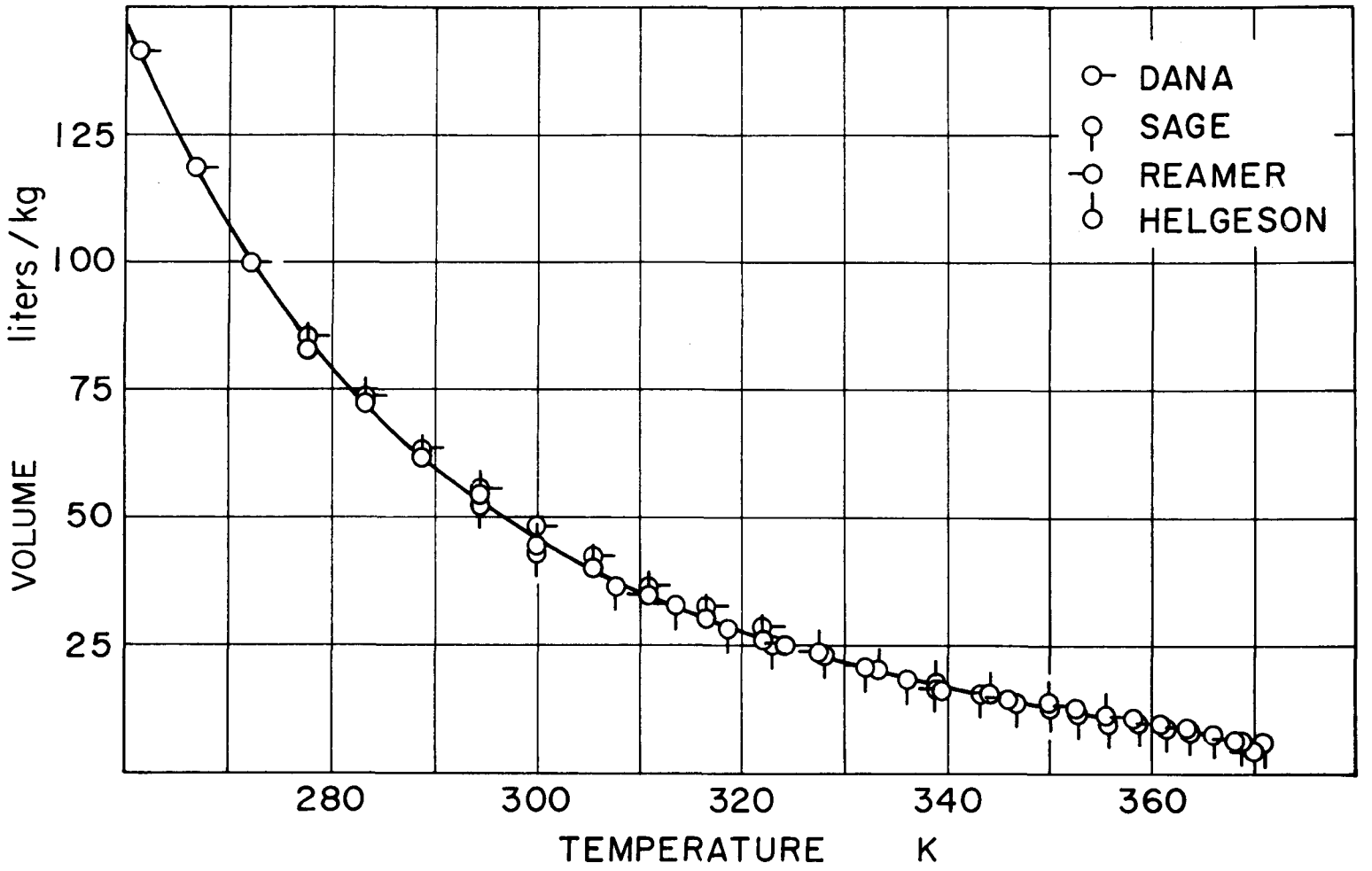

FIGURE 1.1. *Variation in dew point volume of propane with temperature.*

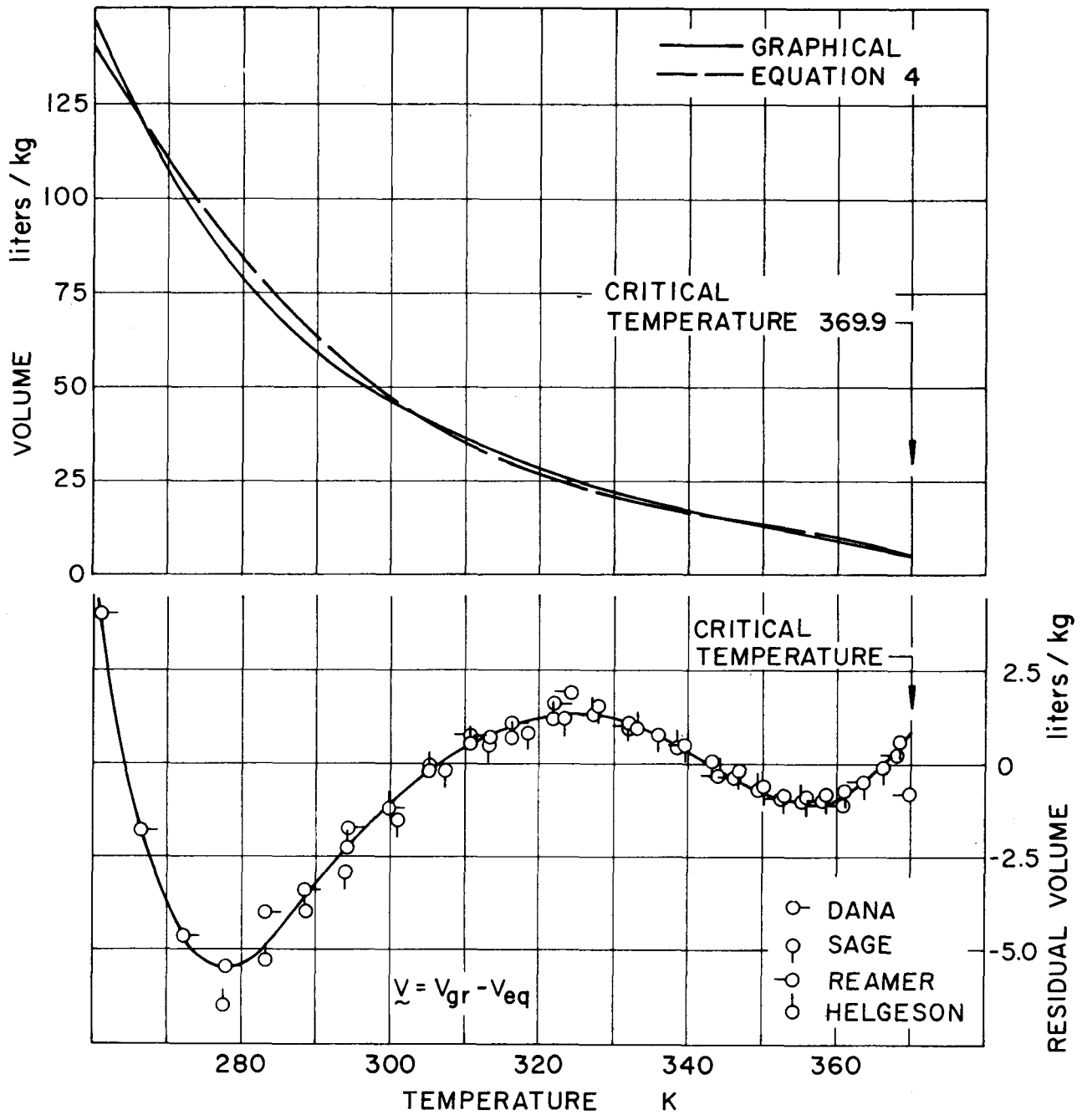

FIGURE 1.2. *Residual dew point volume of propane.*

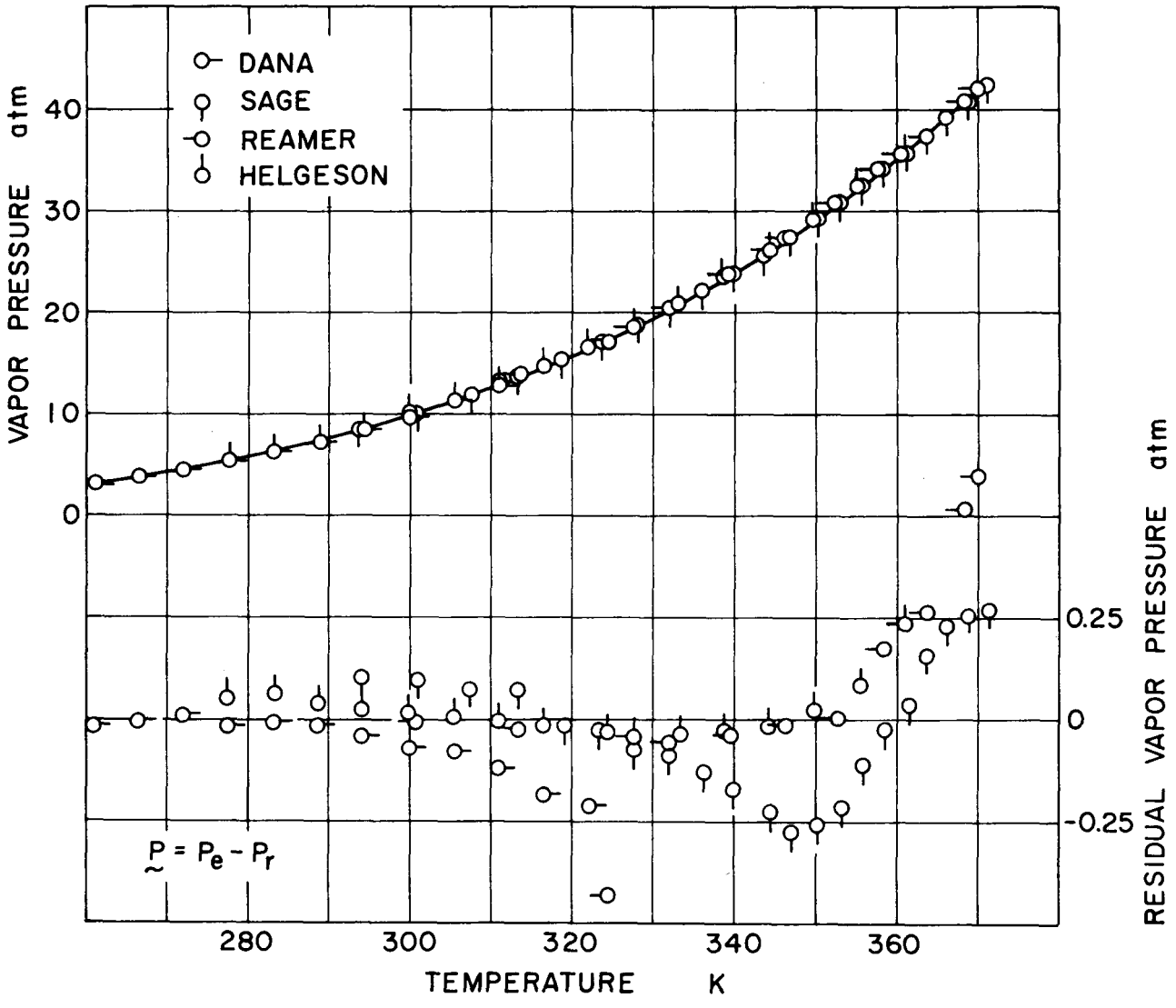

FIGURE 1.3. *Vapor pressure of propane.*

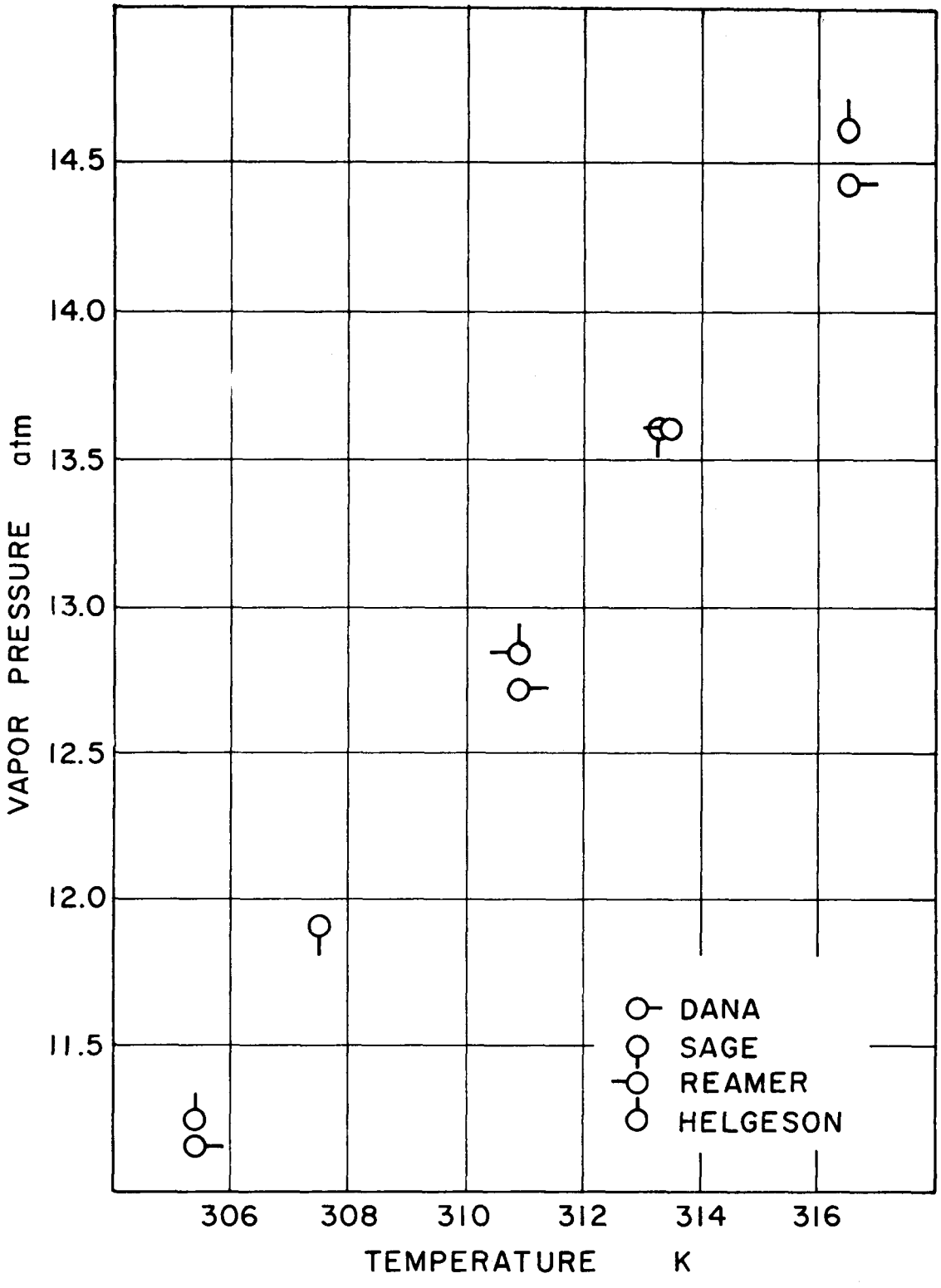

FIGURE 1.4. *Vapor pressure-temperature diagram.*

TABLE 1.1. *Experimental values of dew point volume [a] for propane*

Temperature	Reference				Temperature	Reference			
	Dana [4]	Sage [5]	Reamer [6]	Helgeson [b] [7]		*Dana* [4]	*Sage* [5]	*Reamer* [6]	*Helgeson* [b] [7]
K					*K*				
255.4	169.2				343.5		15.4		
260.9	141.7				344.3			15.2	15.4
266.5	118.6				346.4			14.3	
272.0	99.9				346.9		14.0		
277.6	85.5			82.8	349.8				13.2
283.2	73.7			72.7					
288.7	63.1			62.3	350.1		12.7		
293.9		52.4			352.7			12.1	
294.3	55.1			53.7	353.1		11.6		
299.8	48.1			46.4	355.4				11.3
301.1		43.3			355.9		10.6		
305.4	42.0			40.2	358.3			10.2	
307.5		37.0			358.6		9.6		
310.9	36.9		34.8	34.9	360.9			9.8	9.5
313.3		32.2			361.3		8.8		
313.5			32.6		363.6			8.5	
316.5	32.5			30.4	363.8		8.0		
318.6		28.3			366.3		7.3		
322.0	28.7			26.5	368.4			6.6	
323.4		25.3			368.8		6.5		
324.5			25.6		370.0			4.5	
327.6			23.0	23.1					
327.9		22.8							
332.0			20.6		Estimated uncertainty [c], percent	1.0	0.2	0.2	0.2
332.1		20.5							
333.2				20.2					
336.1		18.6			Deviation				
338.7				17.6	absolute [d]	1.07	0.31	0.28	0.34
339.6			16.8		algebraic [e]	1.07	−0.27	0.22	0.07
339.9		16.9			standard [f]	1.4	0.62	0.39	0.58

[a] Specific volumes expressed in liters/kg.
[b] Specific volume calculated by application of Clapeyron equation to latent heat of vaporization data.
[c] Estimated uncertainty in experimental measurements.
[d] Absolute deviation defined by eq (2).
[e] Average deviation defined by eq (1).
[f] Standard deviation defined by eq (3).

TABLE 1.2. *Residual specific volume of dew point gas for propane*

Temperature	Reference volume [b]	Residual volume [a], liters/kg				
		Dana [4]	Sage [5]	Reamer [6]	Helgeson [7]	Smooth [c]
K						
255.4	156.7	12.4	.....	.....	.....	12.4
260.9	137.7	4.0	.....	.....	.....	4.0
266.5	120.3	−1.7	.....	.....	.....	−1.7
272.0	104.5	−4.6	.....	.....	.....	−4.6
277.6	90.1	−5.4	.....	.....	−6.5	−5.4
283.2	77.3	−4.0	.....	.....	−5.3	−4.9
288.7	66.0	−3.4	.....	.....	−3.6	−3.6
293.9	56.7	.....	−2.9	.....	.....	−2.3
294.3	56.1	−1.8	.....	.....	−2.3	−2.3
299.8	47.6	−1.2	.....	.....	−1.2	−1.1
301.1	45.8	.....	−1.5	.....	.....	−0.9
305.4	40.3	−0.1	.....	.....	−0.2	−.1
307.5	37.8	.....	−0.2	.....	.....	.1
310.9	34.2	.7	.....	0.7	.5	.5
313.3	31.9	.....	.5	.....	.....	.8
313.5	31.7	.....	.....	.7	.....	.8
316.5	29.1	1.1	.....	.....	.7	1.0
318.6	27.5	.....	.8	.....	.....	1.2
322.0	25.0	1.6	.....	.....	1.2	1.3
323.4	24.2	.....	1.2	.....	.....	1.3
324.5	23.5	.....	.....	1.9	.....	1.3
327.6	21.7	.....	.....	1.3	1.3	1.3
327.9	21.5	.....	1.5	.....	.....	1.3
332.0	19.6	.....	.....	1.0	.....	1.1
332.1	19.5	.....	1.1	.....	.....	1.1
333.2	19.1	.....	.....	.....	1.0	1.0
336.1	17.9	.....	0.8	.....	.....	0.8
338.7	17.0	.....	.....	.....	0.4	.5
339.6	16.6	.....	.....	0.4	.....	.4
339.9	16.5	.....	.5	.....	.....	.4
343.5	15.4	.....	.1	.....	.....	−.1
344.3	15.1	.....	.....	−.3	−.3	−.2
346.4	14.5	.....	.....	−.4	.....	−.4
346.9	14.3	.....	.....	−.2	.....	−.5
349.8	13.5	.....	.....	.....	−.7	−.8
350.1	13.4	.....	−.6	.....	.....	−.8
352.7	12.6	.....	.....	−.9	.....	−.9
353.1	12.5	.....	−.8	.....	.....	−.9
355.4	11.8	.....	.....	.....	−1.0	−1.0
355.9	11.6	.....	−.9	.....	.....	−1.0

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TABLE 1.2. *Residual specific volume of dew point gas for propane*—Continued

Temperature	Reference volume [b]	Residual volume [a], liters/kg				
		Dana [4]	Sage [5]	Reamer [6]	Helgeson [7]	Smooth [c]
K						
358.3	10.8	.....	.....	−1.0	.....	−1.0
358.6	10.6	.....	−0.8	.....	.....	−1.0
360.9	9.8	.....	.....	−1.1	−0.9	−0.8
361.3	9.6	.....	−.7	.....	.....	−.8
363.6	8.6	.....	.....	−0.5	.....	−.4
363.8	8.6	.....	−.5	.....	.....	−.4
366.3	7.4	.....	−.1	.....	.....	.0
368.4	6.3	.....	.....	.3	.....	.4
368.8	6.0	.....	.6	.....	.....	.6
370.0	5.3	.....	.....	.....	−.8	.8

[a] Residual specific volume defined by $V_{gr}-V_r$.
[b] Reference volume expressed in liters/kg and defined by eq (4).
[c] Critically chosen values of residual volume.

TABLE 1.3. *Deviations of several sets of experimental data for specific volume of dew point gas for propane*

Deviation	Reference			
	Dana [4]	Sage [5]	Reamer [6]	Helgeson [7]
	Liters/kg	*Liters/kg*	*Liters/kg*	*Liters/kg*
Absolute [a]	0.18	0.20	0.11	0.16
Algebraic [b]	−.07	.02	.07	.08
Standard [c]	.31	.27	.20	.32
Number of Points	13	20	14	16

[a] Absolute deviation defined by eq (2).
[b] Average deviation defined by eq (1).
[c] Standard error of estimate defined by eq (3).

TABLE 1.4. *Experimental values of vapor pressure for propane* [a]

Temperature K	Reference pressure, equation (1.7)	Dana [4]		Sage [5]		Reamer [6]		Helgeson [7]	
		Vapor pressure	Residual pressure [b]	Vapor pressure	Residual pressure [b]	Vapor pressure	Residual pressure [b]	Vapor pressure	Residual pressure [b]
255.4	2.604	2.599	−0.005						
260.9	3.150	3.130	−.020						
266.5	3.779	3.776	−.003						
272.0	4.501	4.511	.010						
277.6	5.323	5.308	−.015					5.376	0.053
283.2	6.254	6.247	−.007					6.314	.061
288.7	7.302	7.288	−.014					7.335	.033
293.9	8.403			8.506	0.103				
294.3	8.477	8.438	−.039					8.506	.029
299.8	9.786	9.717	−.069					9.805	.019
301.1	10.107			10.207	.100				
305.4	11.239	11.160	−.079					11.248	.009
307.5	11.830			11.908	.078				
310.9	12.843	12.724	−.119			12.840	−0.003	12.840	−.003
313.3	13.582			13.609	.027				
313.5	13.634					13.609	−.025		
316.5	14.608	14.426	−.182					14.596	−.012
318.6	15.322			15.310	−.012				
322.0	16.542	16.331	−.211					16.515	−.026
323.4	17.032			17.011	−.022				
324.5	17.448					17.011	−.047		
327.6	18.652					18.610	−.042	18.610	−.042
327.9	18.785			18.713	−.072				
332.0	20.474					20.414	−.060		
332.1	20.498			20.414	−.084				
333.2	20.949							20.910	−.039
336.1	22.243			22.115	−.128				
338.7	23.438							23.408	−.030
339.6	23.854					23.816	−.038		
339.9	23.986			23.816	−.170				
343.5	25.739			25.517	−.222				
344.3	26.128					26.116	−.012	26.116	−.012
346.4	27.234					27.218	−.016		
346.9	27.493			27.218	−.275				
349.8	29.027							29.049	.021
350.1	29.178			28.919	−.259				
352.7	30.619					30.621	.002		
353.1	30.838			30.621	−.217				
355.4	32.142							32.226	.084
355.9	32.433			32.322	−.111				
358.3	33.849					34.023	.174		
358.6	34.050			34.023	−.027				

TABLE 1.4. *Experimental values of vapor pressure for propane* [a]—Continued

Temperature K	Reference pressure, equation (1.7)	Dana [4]		Sage [5]		Reamer [6]		Helgeson [7]	
		Vapor pressure	Residual pressure [b]	Vapor pressure	Residual pressure [b]	Vapor pressure	Residual pressure [b]	Vapor pressure	Residual pressure [b]
360.9	35.479	.....	.....	.....	.....	35.710	.231	35.710	.231
361.3	35.686	.....	.....	35.724	.038	.....	.....	.....	.....
363.6	37.162	.....	.....	.....	.....	37.425	.263	.....	.....
363.8	37.269	.....	.....	37.425	.156	.....	.....	.....	.....
366.3	38.898	.....	.....	39.126	.228	.....	.....	.....	.....
368.4	40.311	.....	.....	.....	.....	40.827	.516	.....	.....
368.8	40.576	.....	.....	40.827	.251	.....	.....	.....	.....
370.0	41.413	.....	.....	.....	.....	42.011	.598	.....	.....
Estimated uncertainty, percent		1.0	.....	0.2	.....	0.2	.....	0.2	.....

[a] Pressures expressed in atmospheres.
[b] Residual pressure calculated from eq (8).

TABLE 1.5. *Deviations in experimental values of vapor pressure for propane*

Deviation [a]	Reference			
	Dana [4]	Sage [5]	Reamer [6]	Helgeson [7]
	atm	*atm*	*atm*	*atm*
Absolute [b]	0.059	0.129	0.173	0.044
Algebraic [c]	−0.058	−0.031	0.082	0.024
Standard [d]	0.094	0.173	0.166	0.071
Number of Points	13	20	14	16

[a] Deviations between experimental and predicted values.
[b] Absolute deviation defined by eq (2).
[c] Average deviation defined by eq (1).
[d] Standard error of estimate defined by eq (3).

2. The *n*-Pentane System

The vapor pressure of *n*-pentane has been studied by numerous investigators [8–13] and the critical properties have been measured many times [8, 9, 12, 14, 15]. The older data suffer from limitations as to the purity of the samples of *n*-pentane employed. For this reason, primary emphasis has been given to the latter measurements which have employed markedly purer materials than those available prior to 1945. Table 1 reports critical properties of *n*-pentane as measured by several investigators. The critically chosen values are recorded in the lower part of the table along with estimated measures of uncertainty.

For the most part, the critically chosen values follow closely those selected by the American Petroleum Institute Project 44 [16]. It was thought that Project 44 had an opportunity to review the critical properties in somewhat greater detail than was done in the present instance. The rather large estimated uncertainty in the critical temperature resulted from the significant variation in the critical temperature reported by Beattie [12] and Ambrose [14]. Likewise, the critical pressure selected by the American Petroleum Institute Project 44 was significantly different from that established from the experimental work of Beattie. For this reason an uncertainty of 0.2 atm was selected. Rather close agreement in the critical volume as established by Beattie [12] from direct volumetric measurement and that selected by the American Petroleum Institute Project 44 [16] resulted in a somewhat smaller estimate of uncertainty than otherwise would have been the case.

Following the graphical techniques that have been described in the introduction to this compilation, the vapor pressure interpolated from the experimental measurements [11–13, 16] is reported in a portion of table 2.2 at 10 degree K. intervals.

The residual vapor pressure of *n*-pentane is shown in figure 2.1. In this instance the reference vapor pressure was established from:

$$\log_{10} P_r = 5.587347 - \frac{2453.45}{T_{0R}} \qquad (2.1)$$

The marked difference in the measurements of Young [9] from those of the other investigators are clearly indicated. Other measurements of Sage [10, 11], Li [13], and Beattie [12] are in rather good agreement. The average fractional deviation and the standard deviation of each set of the experimental data from the critically chosen values are set forth for the vapor pressure of *n*-pentane in the upper part of table 2.3. It is most likely that the measurements of Beattie [12] and Li [13] represent the most accurate measurements. However, the paucity of experimental points made it necessary to place some reliance upon the measurements of Sage [11]. Young's measurements were not given much credence because of their large deviations from the significant body of more recent experimental data which has accumulated. Again, the current critically chosen data follow closely those recommended by American Petroleum Institute Project 44 [16].

Values of the specific volume of the saturated or bubble-point liquid and the saturated or dewpoint gas also have been recorded in a part of table 2.2. These latter data were interpolated from selected measurements [11–13].

Figure 2.2 depicts the bubble-point volume as a function of temperature and presents the data of Li [13], Sage [10, 11], and Young [9]. The data shown in figure 2.2 were based upon direct measurements of the volume in the condensed liquid extrapolated to the vapor pressure. In this instance, it was not necessary to utilize the residual techniques as the variation in the specific or molal volume with pressure was sufficiently small that direct graphical operations were satisfactory. The agreement of the several sets of data for the volume of the bubble-point liquid in comparison with the critically chosen values are set forth in the lower part of table 2.3.

Values of the vapor pressure and the specific volume of the saturated liquid, together with application of the Clapeyron equation to calorimetric measurements of the latent heat of vaporization of *n*-pentane [17], were used to establish the volume of the saturated gas at temperatures below 350 °K.

Figure 2.3 depicts the residual volume at dew point for *n*-pentane as established by several methods. The volume of the gas was smoothed in terms of the compressibility factor which is defined by eq (2.2):

$$Z_k = PV_k/b_kT \qquad (2.2)$$

In this instance, residual graphical methods were deemed sufficient to permit critically chosen values to be established without the need of analytical techniques. The reference volume at dew point was established from:

$$V_r = b_kT/P \qquad (2.3)$$

It is apparent that the calorimetric measurements of Kozicki, et al. [17] and the volumemetric data of Li and Canjar [13] are in good agreement while some of the earlier measurements by Sage and Lacey [10, 11] yielded larger values of the residual volume.

After a review of the information presented in figure 2.3, primary emphasis was placed upon the measurements of Kozicki [17] and Li [13] although the data by Young [9] and Sage [10, 11] at the higher temperatures, for the most part, were in good agreement with the critically chosen values. The agreement of the results obtained from the calorimetric measurements of Kozicki [17] with the

directly measured values of Li [13] Young [9] and Sage [10, 11] yields credence to the critically chosen values.

The standard error of estimate of the smooth data from the experimental values is recorded in table 2.3. This includes a comparison of the agreement of the directly-measured specific volume of the dew-point gas with values calculated from the application of the Clapeyron equation to the available enthalpy changes upon vaporization established from calorimetric measurements [17].

The same information presented in tables 2.1 and 2.2 is also depicted in tables 2.4 and 2.5 in the force-length-time system of dimensions, and the results tabulated in engineering units. The standard errors of estimate are equal for the data presented in tables 2.1 and 2.2, and 2.4 and 2.5, respectively, but they have been repeated in the different sets of dimensions and engineering units in table 2.6 for the convenience of the user. The graphical methods employed in interpolating these data have been applied with different levels of agreement at various ranges of temperature, thus requiring separate measures of uncertainty for each range.

Accuracy—There is recorded in table 2.7 the estimated uncertainty for the vapor pressure, temperature, and volume of the saturated gas and saturated liquid as measured by each of the several investigators. These have been evaluated by the current authors for each of the several investigators, while the over-all summary of the probable uncertainty in the results reported in tables 2.1 and 2.2 is set forth in the lower part of table 2.7. It should be recognized that a certain element of subjective judgment is required in arriving at values of uncertainty which have been ascribed to the several variables. For the most part, uncertainties several times those assigned by the original investigators have been reported in table 2.7.

The measurements of Young resulted from techniques involving confinement of the hydrocarbon in glass over mercury. Likewise, the methods of measurement of pressure were considered to be somewhat less accurate than had been stated by Young. The sample purity was relatively poor by present day standards but Young's [9] measurements on the whole represented an outstanding contribution to the knowledge of hydrocarbons at the time the work was completed. Somewhat later measurements by Sage [10, 11], in the light of this review, probably suffered in the gas phase from adsorption on the walls of the steel pressure vessel within which the hydrocarbon was confined.

The purity of the sample was inadequate to permit the vapor pressure to be established within the uncertainty of the pressure measurements which accounted for the somewhat larger measure of uncertainty indicated in table 2.7 for the vapor pressure than was originally reported by the authors [4]. These measurements of vapor pressure by Li [13] and Beattie [12] are probably as good as any reported and the sample purities were adequate to permit the estimated accuracy of vapor pressure measurements to be of the same order as that estimated by the author [12]. Some difficulties from adsorption undoubtedly influenced the volumetric measurements by Li [13] and Beattie [12] but these were less serious than those found by Sage [11]. The measurements of vapor pressure by Beattie [12] with a sample of relatively high purity are considered of good accuracy. The volumetric studies by Li [13] were not considered as satisfactory as Beattie's [12] techniques and for that reason a larger measure of uncertainty than that indicated by the author has been assigned. Kozicki's [17] calorimetric measurements offered an interesting insight into the overall reliability of the volumetric measurements of the dew-point gas. However, since the first derivative of the vapor pressure with respect to temperature was required to establish the volume of the dew-point gas, a higher uncertainty was assigned to the derived volumetric behavior than existed in the original calorimetric measurements.

There are a number of correlations and reviews of the properties of the paraffin hydrocarbons that include *n*-pentane which were not utilized in the preparation of the tabular information submitted. In table 2.8, however, the more useful reviews are described briefly [18–27].

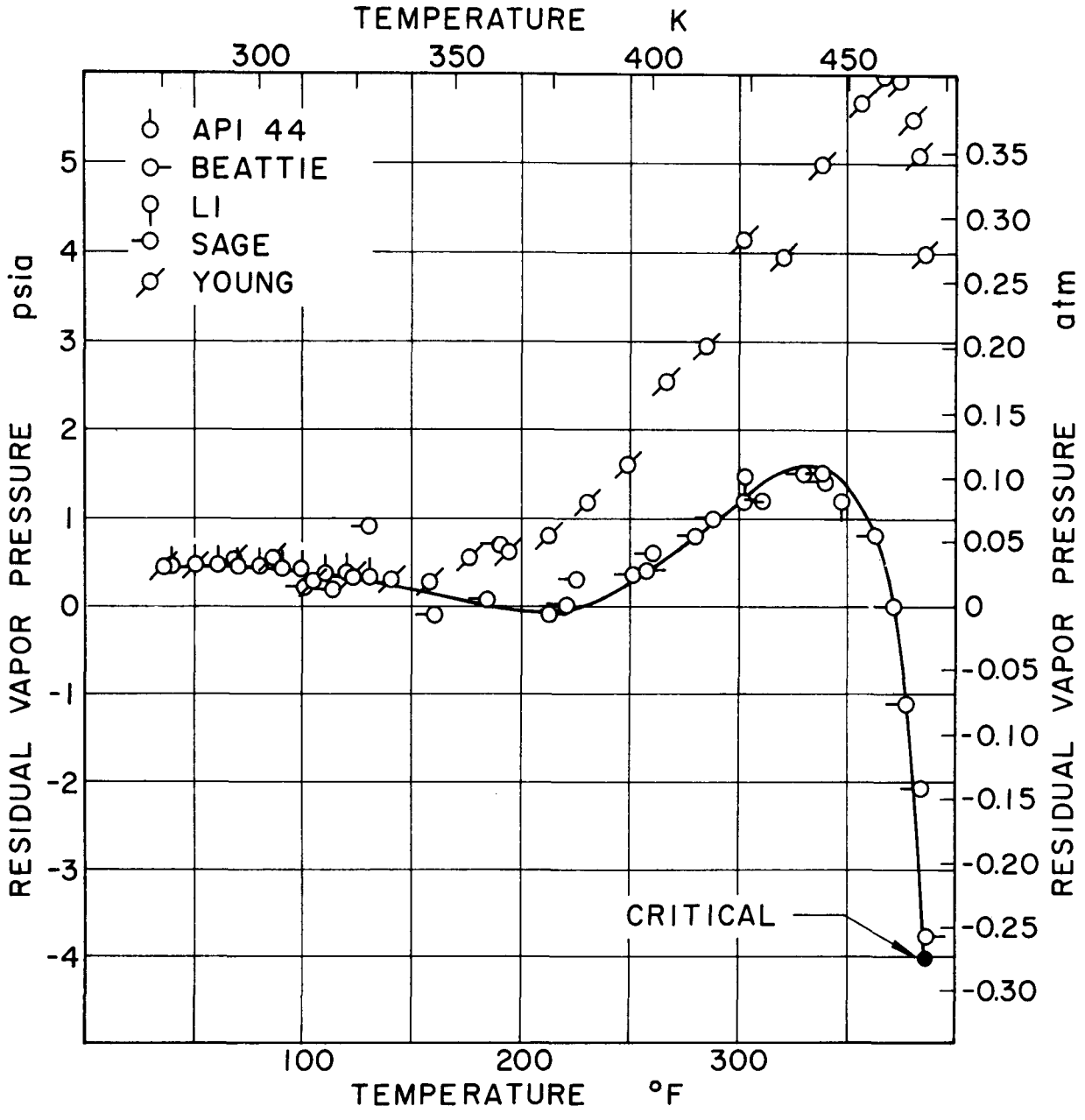

FIGURE 2.1. *Residual vapor pressure of* n-*pentane.*

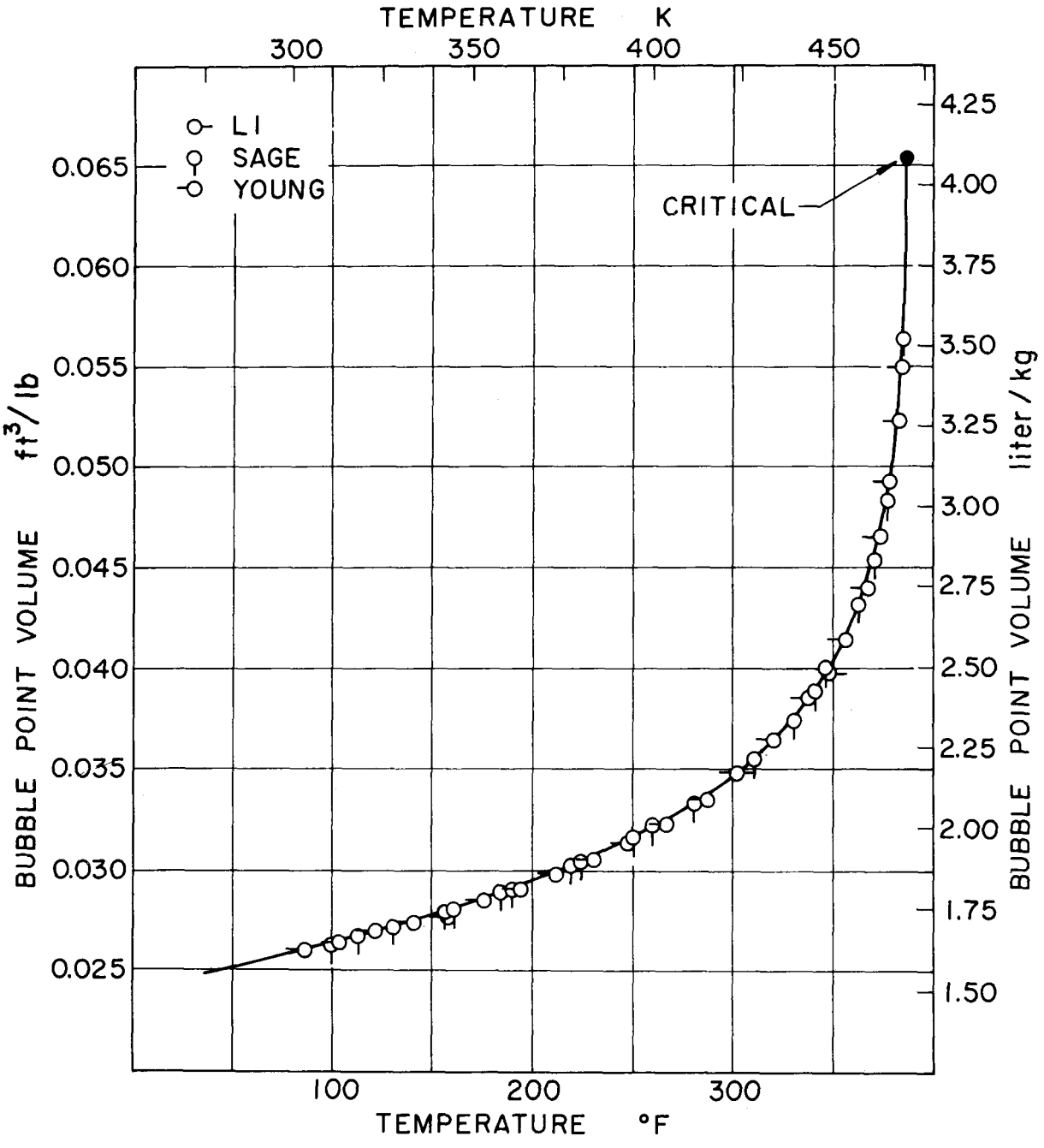

FIGURE 2.2. *Bubble point volume of* n-*pentane.*

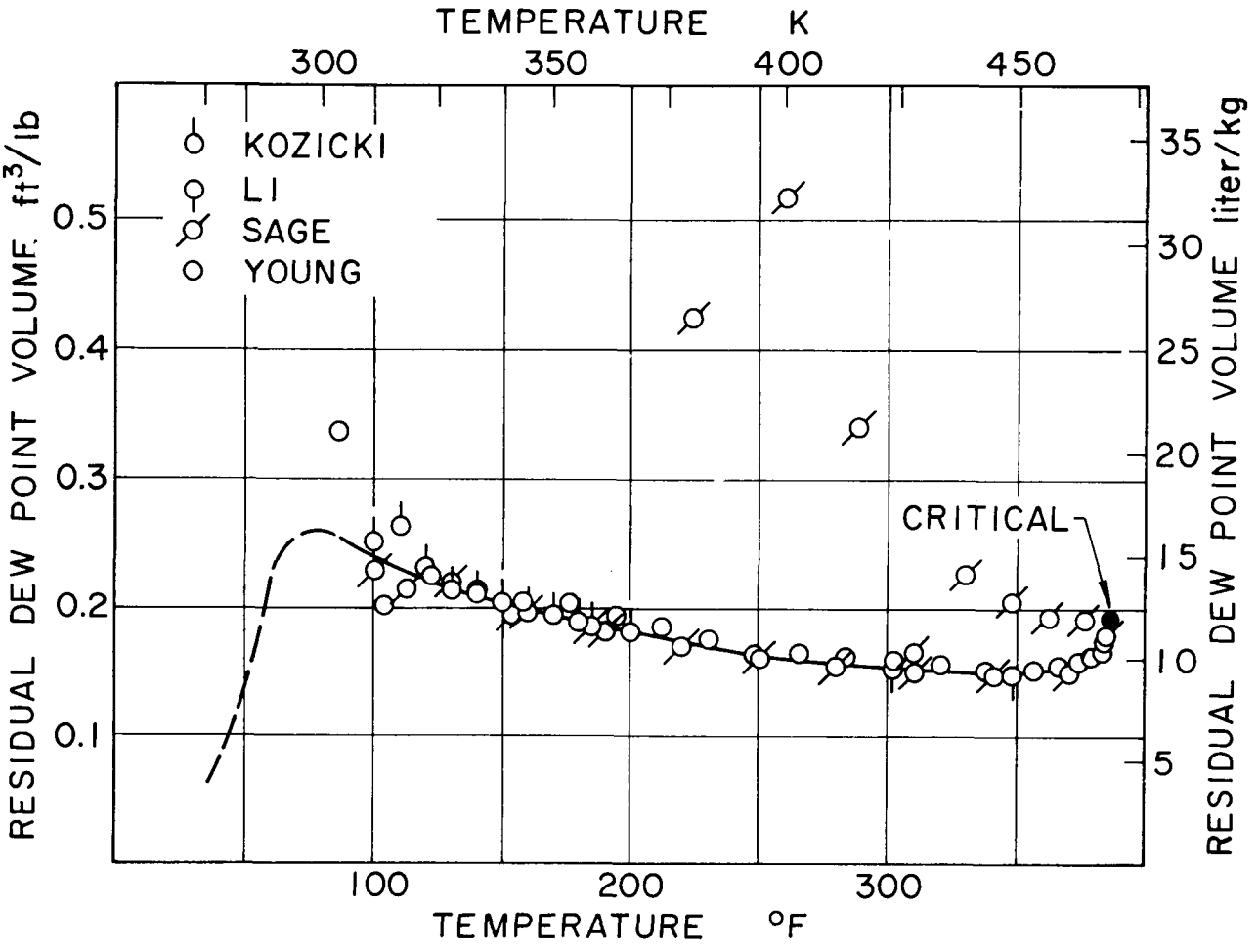

FIGURE 2.3. *Residual volume at dew point for* n-*pentane.*

TABLE 2.1. *Critical properties of* n-*pentane*

Source	Temperature	Pressure	Volume	
	K	*Atm*	*Liters/kg*	*Liters/kg-mol*
Young [9]	470.4	33.0	4.31	310.9
Sage [11]	470.4	33.6	4.36	314.6
Beattie [12]	469.8	33.31	4.09	295
Ambrose [14]	469.5			
Partington [15]	469.6			
API 44 [16]	469.49	33.16	4.08	295
Critically chosen value	469.49	33.16	4.08	294.6
Estimated uncertainty	0.7	0.2	0.04	2.9
Estimated uncertainty, percent	0.1	0.5	1.0	

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TABLE 2.2 *Properties of the coexisting phases for* n-*pentane*

Temperature	Vapor pressure [a]	Volume			
		Dew point		Bubble point	
K	*Atm*	*Liters/kg*	*Liters/kg-mol*	*Liters/kg*	*Liters/kg-mol*
280	0.32	970.9	70.06×10^3	1.561	112.7
290	0.49	656.1	47.34	1.586	114.4
300	0.72	421.0	30.38	1.616	116.6
310	1.03	328.4	23.70	1.641	118.4
320	1.42	241.8	17.45	1.672	120.7
330	1.93	181.1	13.07	1.706	123.0
340	2.57	138.2	9.970	1.739	125.5
350	3.38	107.1	7.728	1.774	128.0
360	4.31	83.4	6.017	1.813	130.8
370	5.45	65.92	4.756	1.855	133.8
380	6.81	52.67	3.800	1.902	137.2
390	8.41	42.31	3.053	1.952	140.8
400	10.3	33.07	2.476	2.010	145.0
410	12.4	27.74	2.001	2.073	149.6
420	14.9	22.50	1.623	2.146	154.9
430	17.7	18.19	1.312	2.232	161.1
440	20.9	14.60	1.054	2.358	170.1
450	24.5	11.57	0.8347	2.525	182.2
460	28.6	7.791	.5621	2.792	201.4
469.49 [b]	33.16	4.08	.295	4.08	295

[a] *(Atm)* $(1.013250 \times 10^5) = N/m^2$
[b] Critical state [16]

TABLE 2.3. *Agreement of interpolated and experimental data for* n-*pentane*

Source	Number of points	Average [a]	Deviation Fraction [b]	Standard [c]
		Vapor pressure, atm		
Young [9]	24	−0.164	0.0102	0.248
Sage [11]	22	−.010	.0044	.019
Beattie [12]	4	.005	.0003	.010
Li [13]	2	.001	.0008	.....
API 44 [16]	10	−.001	.0018	.003
Overall [d]	38	−.005	.0031	.015
		Dew-point volume, liters/kg		
Young [e] [9]	21	−0.27	0.0050	0.62
Sage [11]	23	.23	.0077	1.21
Li [13]	2	.08	.0056	.....
Kozicki [f] [17]	11	−.42	.0024	0.97
Overall	57	−.08	.0056	.93
		Bubble-point volume, liters/kg		
Young [e] [9]	21	−0.0303	0.0124	0.002
Sage [11]	23	.00071	.0008	.062
Li [13]	2	−.0687	.0030	.....
Overall	46	.0164	.0062	.041

[a] Average deviation defined by $\left[\sum_{1}^{N}(G_{exp}-G_{sm})\right]/N$

[b] Average fractional deviation defined by $\left\{\sum_{1}^{N}\left[(G_{exp}-G_{sm})/G_{exp}\right]\right\}/N$

[c] Standard deviation defined by $\left\{\left[\sum_{1}^{N}(G_{exp}-G_{sm})^2\right]/(N-1)\right\}^{1/2}$ where G = pressure or volume

[d] Excluding Young's vapor pressure data
[e] Values of deviations for Young not comparable since data employed had been smoothed.
[f] Calorimetric data for temperatures between 311 and 350 K.

TABLE 2.4. *Critical properties of the* n-*pentane system, engineering units*

Source	Temperature	Pressure	Volume	
	°*F*	*psia*	*cu ft/lb*	*cu ft/lb-mol*
Young [9]	386.96	485.4	0.0690	4.98
Sage [11]	387	494	.0699	5.04
Beattie [12]	385.95	489.5	.0655	4.73
Ambrose [14]	385.41	.....	.....	.....
Partington [15]	385.5	.....	.....	.....
API 44 [16]	385.41	487.3	.0654	4.72
Critically chosen value	385.41	487.3	0.0654	4.72
Estimated uncertainty	0.4	3.0	0.0007	0.05
Estimated uncertainty, percent	0.1	0.5	1.0	

TABLE 2.5. *Properties of the coexisting phases for* n-*pentane, engineering units*

Temperature	Vapor pressure [a]	Volume			
		Dew point		Bubble point	
°F	*psia*	*cu ft/lb*	*cu ft/lb-mol*	*cu ft/lb*	*cu ft/lb-mol*
40	4.30	17.2	1240	0.02491	1.797
50	5.48	13.7	986	.02510	1.811
60	6.89	11.0	795	.02532	1.827
70	8.56	8.95	646	.02556	1.846
80	10.6	6.74	487	.02580	1.862
90	12.9	6.12	441	.02612	1.885
100	15.6	5.108	378.7	.02634	1.900
110	18.6	4.325	312.1	.02662	1.921
120	22.3	3.643	262.8	.02691	1.942
130	26.4	3.104	224.0	.02719	1.962
140	31.1	2.660	191.9	.02750	1.984
150	36.4	2.280	164.5	.02779	2.005
160	42.4	1.978	142.8	.02810	2.027
170	49.0	1.716	123.8	.02842	2.051
180	56.5	1.494	107.8	.02876	2.075
190	64.8	1.306	94.23	.02912	2.101
200	73.9	1.145	82.61	.02948	2.127
210	84.0	1.008	72.73	.02987	2.155
220	95.1	0.8886	64.11	.03028	2.185
230	107.2	.7877	56.83	.03072	2.216
240	120.4	.6966	50.26	.03143	2.268
250	134.7	.6184	44.62	.03166	2.284
260	150.3	.5498	39.67	.03219	2.323
270	167.3	.4892	35.30	.03273	2.362
280	185.6	.4353	31.41	.03333	2.405
290	205.4	.3875	27.96	.03396	2.450
300	226.7	.3452	24.91	.03467	2.501
310	249.7	.3067	22.13	.03548	2.560
320	274.3	.2718	19.61	.03641	2.627
330	300.8	.2405	17.35	.03752	2.707
340	329.1	.2118	15.28	.03884	2.802
350	359.4	.1853	13.37	.04043	2.917
360	392.0	.1600	11.54	.04246	3.064
370	426.8	.1348	9.726	.04548	3.281
380	461.3	.1106	2.980	.05109	3.686
385.41 [b]	487.3	.0654	4.73	.0654	4.72

[a] (Psia) $(6.89475 \times 10^3) = N/m^2$.
[b] Critical state [16].

TABLE 2.6. *Agreement of interpolated and experimental data for* n-*pentane, engineering units*

Source	Number of points	Average [a]	Deviation fraction [b]	Standard [c]
Vapor pressure, psia				
Young [9]	24	−2.41	0.0102	3.65
Sage [11]	22	−0.15	.0044	0.28
Beattie [12]	4	.07	.0003	.14
Li [13]	2	.02	.0008	.....
API 44 [16]	10	−.02	.0018	.04
Overall [d]	38	−.08	.0031	.22
Dew-point volume, cu ft/lb				
Young [e] [9]	21	−0.0043	0.0050	0.0099
Sage [11]	23	.0037	.0077	.0194
Li [13]	2	.0014	.0056	.....
Kozicki [f] [17]	11	−.0067	.0024	.0156
Overall	57	−.0014	.0056	.0149
Bubble-point volume, cu ft/lb				
Young [e] [9]	21	−0.00048	0.0124	0.00003
Sage [11]	23	.00011	.0008	.00100
Li [13]	2	−.0011	.0030	.....
Overall	46	.00026	.0062	.00065

[a] Average deviation defined by $\left[\sum_{1}^{N}(G_{exp}-G_{sm})\right]/N$.

[b] Average fractional deviation defined by $\left\{\sum_{1}^{N}\left[(G_{exp}-G_{sm})/G_{exp}\right]\right\}/N$.

[c] Standard deviation defined by $\left\{\left[\sum_{1}^{N}(G_{exp}-G_{sm})^2\right]/(N-1)\right\}^{1/2}$ where G = pressure or volume.

[d] Excluding Young's vapor pressure data.
[e] Values of deviations for Young not comparable since data employed had been smoothed.
[f] Calorimetric data for temperatures between 100 and 170 °F.

TABLE 2.7. *Accuracy of experimental background for* n-*pentane*

Quantity	Units	Young [9]	Sage [11]	Beattie [12]	Li [13]	Kozicki [17] [a]
Sample purity	mole fr	0.95	0.9970	0.9985	0.9988	0.9998 [b]
Vapor pressure	percent	.5	.3	.2	.2	.....
Volumetric behavior	percent	.5	.5	.3	.4	.5

[a] Includes uncertainty in dew-point volume calculated from Clapeyron equation.
[b] Reported by vendor. The specific weight of the liquid and the index of refraction agree closely with critically chosen values. The reported purity seems higher than would be expected.

TABLE 2.8. *Reviews of properties of the paraffin hydrocarbons*

Subject	Treatment	Reference
Vapor pressure	Correlation. Equation of state	[18]
Vapor pressure	Review and re-evaluation of experimental data	[19]
Vapor pressure	Correlation. Empirical constants	[20]
Critical constants	Correlation. Van der Waals constants	[21]
Critical constants	Review of experimental data	[22]
Vapor pressure	Correlation. Semi-empirical equation	[23]
Thermodynamic properties	Re-evaluation of experimental data	[24]
Critical constants	Correlation. Van der Waals constants	[25]
Vapor pressure	Correlation. Semi-empirical equation of state	[26]
Physical constants	Correlation. Statistical theory of liquids	[27]

3. The Methane-*n*-Pentane System

The methane-*n*-pentane system has been subject to significant experimental study at temperatures above ambient. However, only a limited investigation is available for temperatures below 37.7 °C [28].

The vapor pressure of methane has been studied extensively [16, 29–32], and the critical state of the hydrocarbon measured [16, 29, 33, 34]. Likewise, the vapor pressure of *n*-pentane was studied by Young and others [8, 9, 12, 13], and the critical properties determined [9, 12, 14, 16].

The phase behavior and the volumetric characteristics of the coexisting phases in the methane-*n*-pentane system have been established [35–38]. A comparison of the phase behavior of several hydrocarbon systems containing methane, with particular emphasis on the critical states, also has been presented [39]. In addition, a review was made of the phase equilibria data for the methane-*n*-pentane system, and of similar data for other binary systems [40]. No new experimental data were included in either of the above reviews.

Utilizing the graphical techniques which have been described in the introduction to this compilation, the aforementioned experimental data were smoothed with respect to pressure and temperature. The composition and the specific volume of the coexisting phases also were interpolated as a function of pressure and temperature. In table 3.1 are recorded the composition, molal volumes, specific volumes, and molal equilibrium ratios of the coexisting phases for mixtures of methane and *n*-pentane. The data are reported at temperatures from 280 to 470 K. for pressures from the vapor pressure of *n*-pentane to a maximum of 170 atmospheres. The data have been recorded for even values of pressure expressed in atmospheres for each 10 K. temperature interval. The standard error of estimate of the smooth curves employed for interpolating these data from the experimental results are set forth in table 3.2. The characteristics of the unique states, including the critical state, the point of maximum temperature, and the maximum pressure for mixtures of constant composition, are listed in table 3.3. These values of pressure and temperature for each of the three unique states, as well as a rough estimate of the specific volume for the critical state, are reported as a function of weight fraction methane. The data recorded in table 3.3 were obtained by suitable graphical operations based upon experimental volumetric and phase equilibrium data. The estimated uncertainties for each property have been included in the tabulation.

Since many persons having an occasion to utilize this information are concerned with the force-length-time system of dimensions, the above described data expressed in these dimensions are reported in conventional engineering units in tables 3.4 and 3.5. The composition and the specific volume of the coexisting phases in the methane-*n*-pentane system are reported in table 3.4, and the properties of the unique states in table 3.5.

The standard error of estimate of the smooth curves used in the evaluation of these quantities is identical with that reported in table 3.2. However, for the sake of completeness, it has been presented in table 3.6 and expressed in the units used in tables 3.4 and 3.5. In preparing the tabulations shown in tables 3.1 to 3.2, an effort has been made to present the data in sufficient detail to permit the use of four-point linear interpolation in order to evaluate properties at any chosen temperature, and pressure or composition with a precision at least equal to the accuracy of the data.

In order to illustrate the nature of the phase behavior of this system, a pressure-temperature diagram showing dew points and bubble points for three mixtures of constant composition and the vapor pressure of *n*-pentane is shown in figure 3.1.

In figure 3.1 the effect of temperature upon the critical state of the methane-*n*-pentane system has also been shown. Since it was, from necessity, estimated from the observed volumetric behavior at states near the critical state, the data have been indicated as an estimated quantity. The critical state for a binary mixture can be considered to be that

state at which the properties of the coexisting phases become continuously identical. For example, the critical state can be approached by an increase in temperature under isobaric conditions or by an increase in pressure under isothermal conditions or by any chosen polytropic path. In addition, the estimated maximum pressure at which two phases exist for a given temperature has been indicated. This state often differs materially from the critical state for a mixture of the same composition, as is indicated for a mixture containing 0.50 mole fraction methane. However, this state has been called "maxcondenbar" as being the maximum condensation pressure for a given mixture. It should be recognized that the maxcondenbar becomes equa to the critical pressure at the maximum two-phase pressure for the system as a whole. The maximum two-phase temperature for a mixture of a given composition also has been shown and has been entitled the "maxcondentherm." It is again emphasized that the loci of the maxcondenbar and the maxcondentherm as well as the critical represent estimated quantities established from measured volumetric and phase behavior and not from direct observation of these quantities.

In figure 3.2 is depicted the equilibrium ratio as a function of pressure for each of several temperatures. The product of the pressure and the equilibrium ratio was employed in figure 3.2 to permit the data to be presented with greater precision.

The molal equilibrium ratio, K, is defined in the nomenclature and represents the ratio of the mole fraction of a given component in the gas phase to that in the coexisting liquid phase at the same temperature and pressure. This quantity is often employed to represent the phase behavior of the system since the ratio can often be effectively employed in phase equilibrium calculations to greater advantage than values of the compositions of the coexisting phases.

It should be recognized that the equilibrium ratio always is unity at the critical state, Thus in the case of figure 3.2 the critical locus is identified by a line crossing the diagram in such a fashion that the product of the pressure and the equilibrium ratio and the pressure are everywhere equal. It also should be recognized that the equilibrium ratio for the less volatile component becomes equal to unity when the pressure is equal to the vapor pressure of that component. The lower pressure boundary of the heterogeneous region is thus established by the vapor pressure of the less volatile component.

The effect of pressure upon the composition of the coexisting phases and upon the critical state has been shown in figure 3.3. The curves shown in this figure represent the phase behavior for a particular temperature as the pressure is changed. The critical state in this instance represents the highest pressure at which two phases may coexist for a given temperature. Such behavior can also be seen in figure 3.1. However, it must be recognized that in cases of mixtures of a given composition the critical state is neither the highest pressure nor the highest temperature at which two phases can coexist throughout most of the pressures and temperatures where heterogeneous equilibrium exists. The estimated locus of maxcondenbar and maxcondentherm have also been indicated in figure 3.3, and for a given temperature represents the dew point gas, in this instance, containing the largest mole fraction of methane. Figures 3.4, 3.5, and 3.6 show the same information in terms of the force-length-time system of dimensions expressed in engineering units.

Accuracy—For those interested in the critical evaluation of the experimental accuracy underlying the information presented in tables 3.1 to 3.5, a critical review of the uncertainties associated with the measurements of the several investigators has been made and is set forth in table 3.7. In any such evaluation it is difficult to maintain objectivity. However, it is believed that the values of uncertainty presented in table 3.7 have been arrived at by conservative judgment and formal statistical procedures, such as described in the introduction. The uncertainties assigned to each of the variables by the current authors are from two to four times that reported by the original investigators.

It should be recognized that the majority of the values reported in table 3.7 do not apply to the behavior in the vicinity of the critical state where the uncertainties may be many times as great, since these states were not established by direct experimental observation. There is need for additional experimental work involving the determination of the critical state by visual observation and by indirect measurements of the intensive properties of the coexisting phases, in order to permit an objective appraisal of the accuracy with which the properties of the system near the critical state have been established.

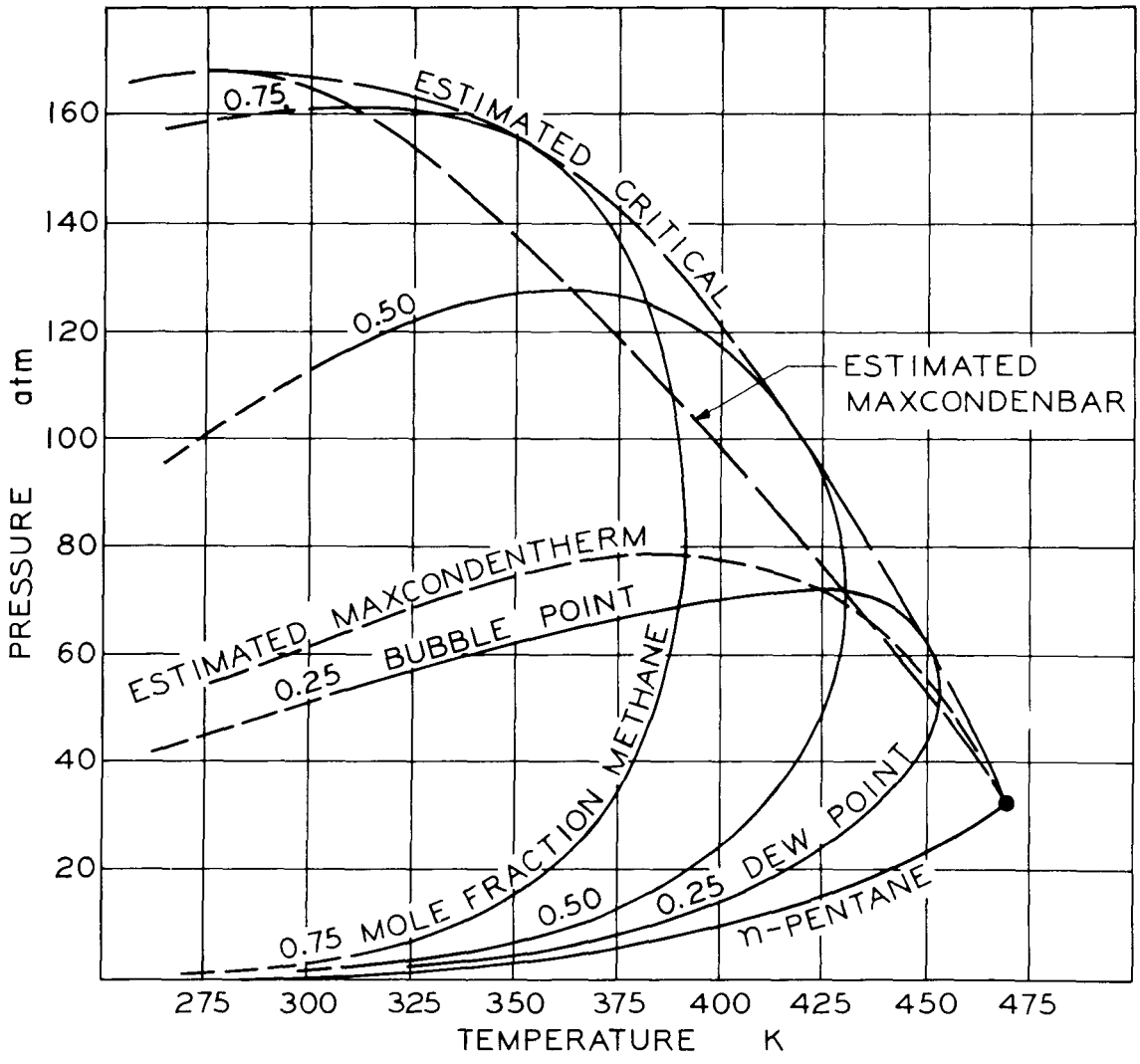

FIGURE 3.1. *Pressure-temperature diagram for methane-n-pentane system.*

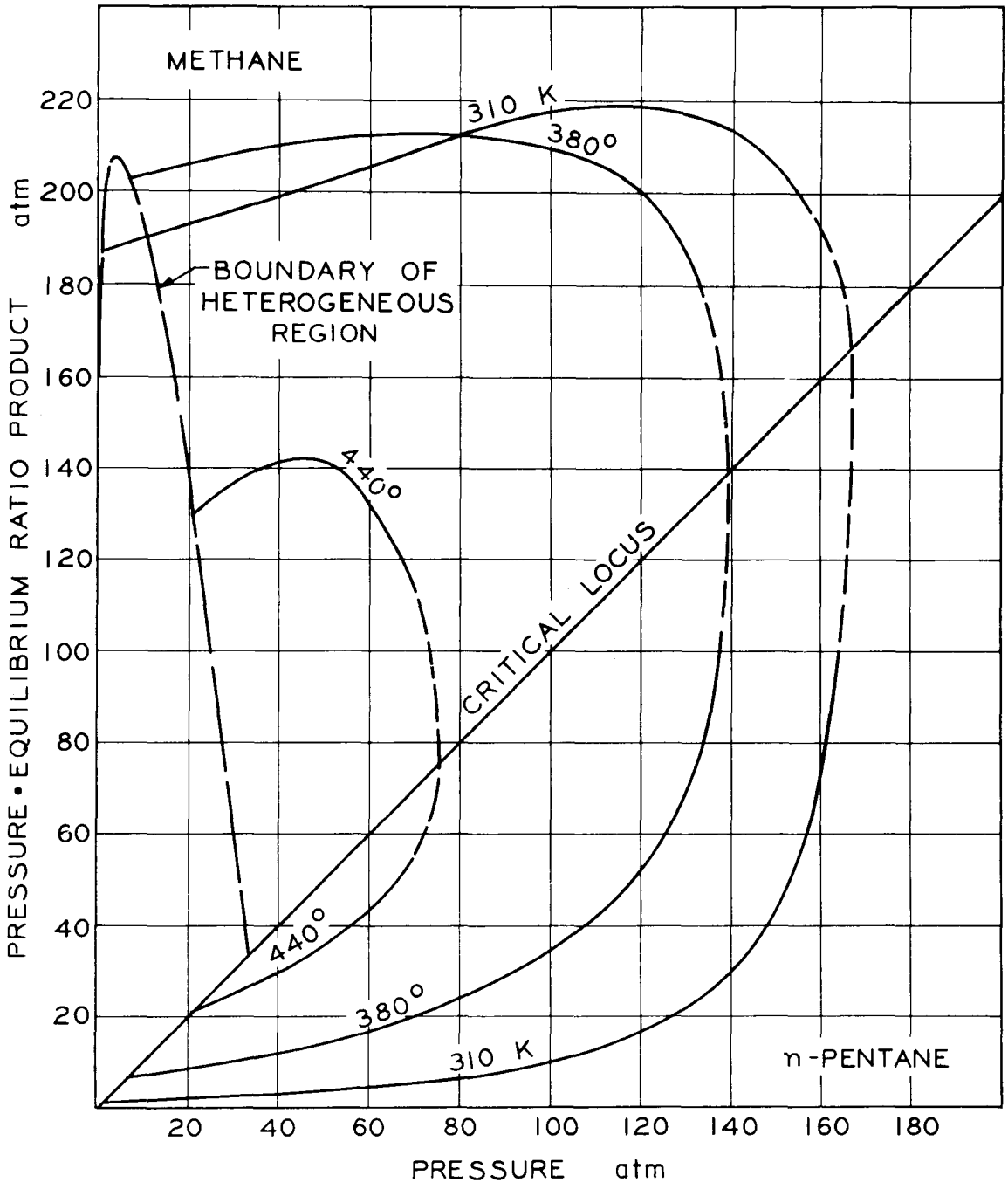

FIGURE 3.2. *Effect of pressure upon equilibrium ratio for methane-n-pentane system.*

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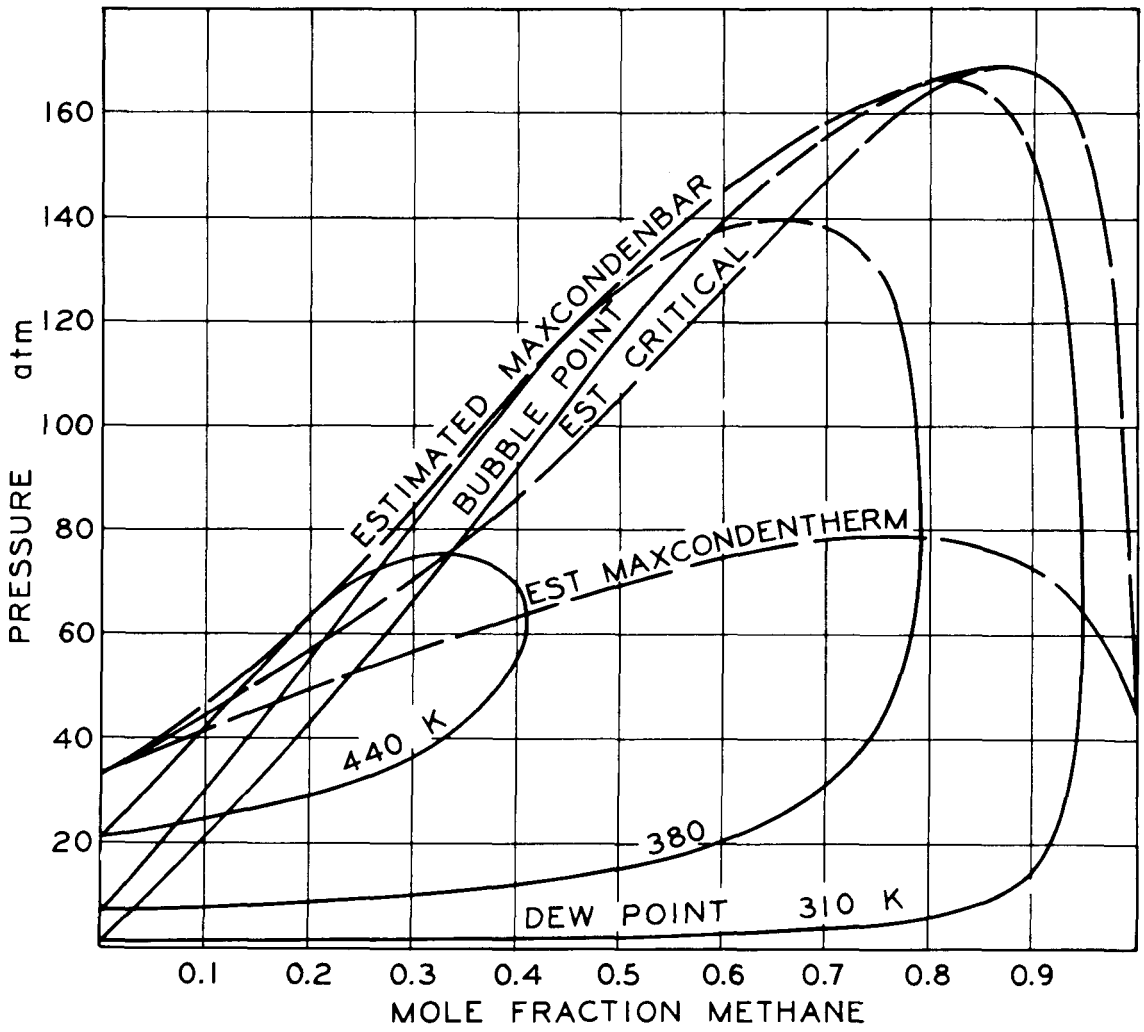

FIGURE 3.3. *Pressure-composition diagram for methane-n-pentane system.*

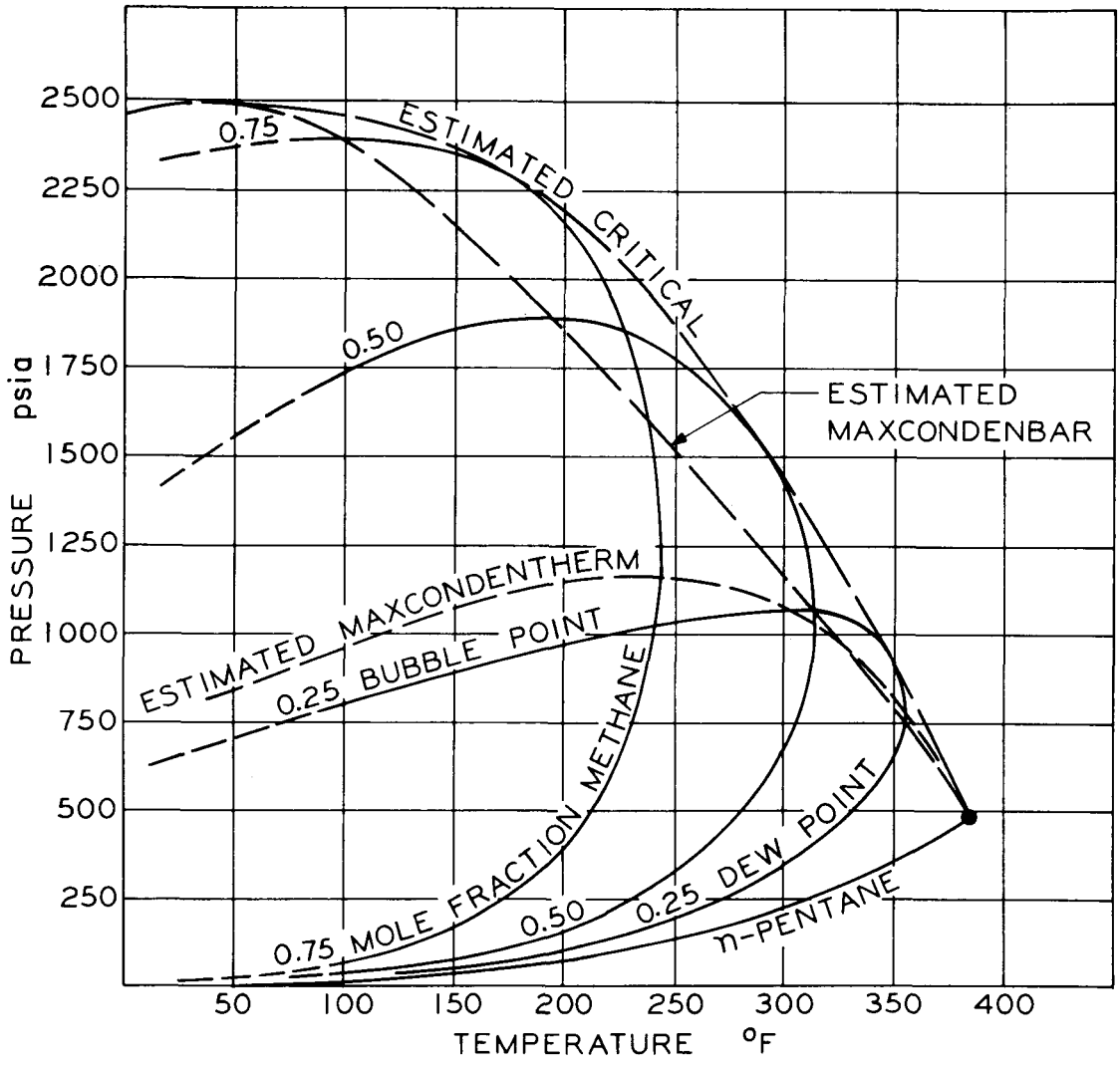

FIGURE 3.4. *Pressure-temperature diagram for methane-n-pentane system, engineering units.*

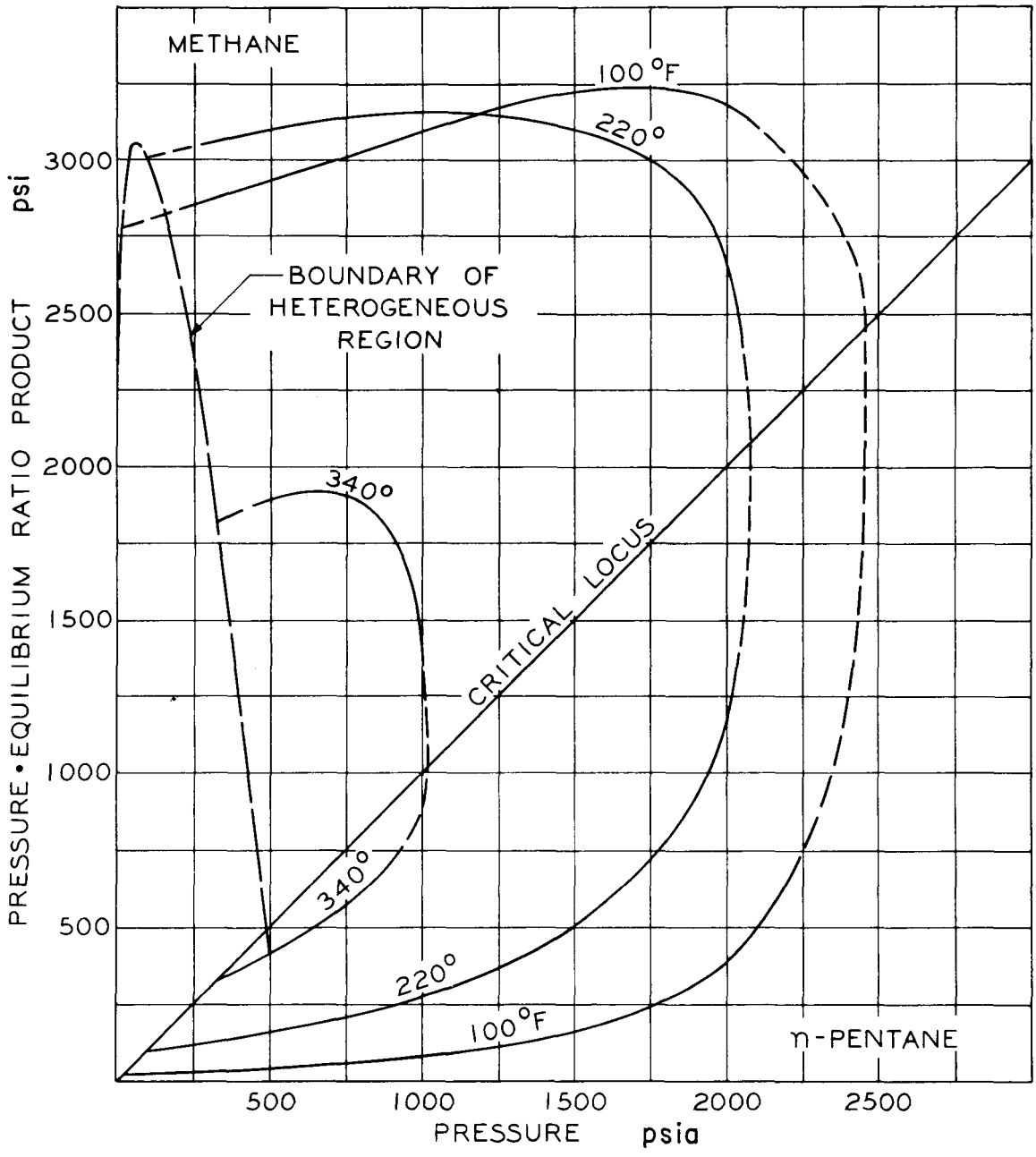

FIGURE 3.5. *Effect of pressure upon equilibirum ratio for methane-*n*-pentane system, engineering units.*

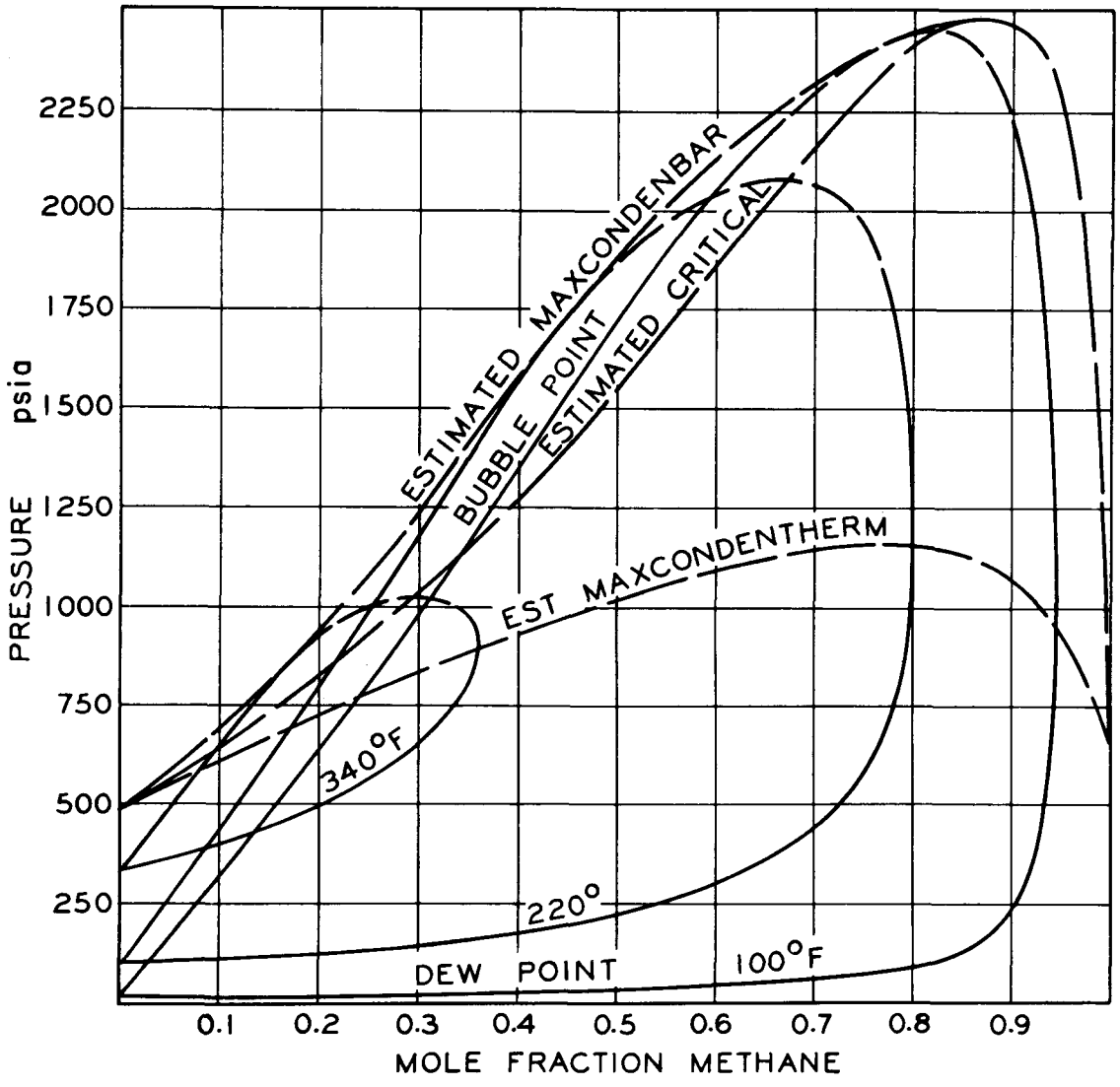

FIGURE 3.6. *Pressure composition diagram for methane-*n*-pentane system, engineering units.*

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TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 280					
0.4	0.100	0.024	0.566E 05	0.851E 03	0.000	0.000	0.113E 03	0.156E 01	3.98E 02	9.00E-01
0.6	0.367	0.114	0.377E 05	0.733E 03	0.001	0.000	0.113E 03	0.156E 01	2.66E 02	6.33E-01
0.8	0.501	0.183	0.283E 05	0.643E 03	0.002	0.001	0.113E 03	0.156E 01	1.99E 02	5.00E-01
1.0	0.581	0.236	0.226E 05	0.572E 03	0.004	0.001	0.112E 03	0.156E 01	1.59E 02	4.20E-01
1.2	0.643	0.286	0.188E 05	0.523E 03	0.005	0.001	0.112E 03	0.156E 01	1.33E 02	3.58E-01
1.4	0.695	0.336	0.162E 05	0.487E 03	0.006	0.001	0.112E 03	0.156E 01	1.14E 02	3.07E-01
1.6	0.733	0.379	0.141E 05	0.456E 03	0.007	0.002	0.112E 03	0.156E 01	9.99E 01	2.69E-01
1.8	0.758	0.410	0.126E 05	0.424E 03	0.008	0.002	0.112E 03	0.156E 01	8.88E 01	2.44E-01
2.0	0.782	0.444	0.113E 05	0.400E 03	0.010	0.002	0.112E 03	0.156E 01	8.00E 01	2.20E-01
4.0	0.892	0.648	0.564E 04	0.256E 03	0.022	0.005	0.111E 03	0.157E 01	4.02E 01	1.10E-01
6.0	0.928	0.740	0.375E 04	0.186E 03	0.034	0.008	0.111E 03	0.157E 01	2.70E 01	7.50E-02
8.0	0.943	0.786	0.280E 04	0.145E 03	0.046	0.011	0.110E 03	0.158E 01	2.04E 01	6.00E-02
10.0	0.949	0.806	0.223E 04	0.118E 03	0.058	0.013	0.109E 03	0.158E 01	1.64E 01	5.40E-02
12.0	0.955	0.825	0.185E 04	0.995E 02	0.069	0.016	0.108E 03	0.159E 01	1.38E 01	4.83E-02
14.0	0.958	0.835	0.157E 04	0.856E 02	0.081	0.019	0.108E 03	0.159E 01	1.19E 01	4.57E-02
16.0	0.961	0.845	0.137E 04	0.752E 02	0.092	0.022	0.107E 03	0.160E 01	1.04E 01	4.31E-02
18.0	0.963	0.851	0.121E 04	0.668E 02	0.103	0.025	0.106E 03	0.160E 01	9.34E 00	4.17E-02
20.0	0.965	0.858	0.109E 04	0.602E 02	0.114	0.028	0.106E 03	0.161E 01	8.45E 00	4.00E-02
25.0	0.968	0.872	0.858E 03	0.481E 02	0.141	0.035	0.104E 03	0.162E 01	6.87E 00	3.68E-02
30.0	0.971	0.881	0.706E 03	0.399E 02	0.167	0.043	0.103E 03	0.164E 01	5.81E 00	3.50E-02
35.0	0.973	0.888	0.597E 03	0.340E 02	0.193	0.050	0.101E 03	0.165E 01	5.05E 00	3.37E-02
40.0	0.974	0.893	0.516E 03	0.295E 02	0.217	0.058	0.998E 02	0.166E 01	4.48E 00	3.32E-02
45.0	0.975	0.895	0.453E 03	0.259E 02	0.241	0.066	0.984E 02	0.168E 01	4.04E 00	3.33E-02
50.0	0.975	0.897	0.403E 03	0.231E 02	0.265	0.074	0.971E 02	0.170E 01	3.68E 00	3.38E-02
55.0	0.975	0.898	0.361E 03	0.207E 02	0.288	0.083	0.958E 02	0.171E 01	3.38E 00	3.45E-02
60.0	0.975	0.898	0.327E 03	0.188E 02	0.311	0.091	0.946E 02	0.173E 01	3.14E 00	3.58E-02
65.0	0.975	0.898	0.298E 03	0.171E 02	0.333	0.100	0.934E 02	0.175E 01	2.93E 00	3.69E-02
70.0	0.975	0.898	0.273E 03	0.157E 02	0.354	0.109	0.922E 02	0.176E 01	2.75E 00	3.83E-02
75.0	0.975	0.897	0.252E 03	0.144E 02	0.375	0.118	0.911E 02	0.178E 01	2.60E 00	4.00E-02
80.0	0.975	0.896	0.233E 03	0.133E 02	0.396	0.127	0.900E 02	0.180E 01	2.46E 00	4.17E-02
85.0	0.974	0.895	0.216E 03	0.124E 02	0.416	0.137	0.889E 02	0.182E 01	2.34E 00	4.36E-02
90.0	0.974	0.893	0.202E 03	0.115E 02	0.436	0.147	0.878E 02	0.184E 01	2.23E 00	4.62E-02
95.0	0.973	0.890	0.188E 03	0.107E 02	0.456	0.157	0.867E 02	0.186E 01	2.13E 00	4.94E-02
100.0	0.972	0.886	0.177E 03	0.100E 02	0.476	0.168	0.857E 02	0.189E 01	2.04E 00	5.30E-02
105.0	0.971	0.881	0.166E 03	0.939E 01	0.495	0.179	0.847E 02	0.191E 01	1.96E 00	5.77E-02
110.0	0.969	0.874	0.156E 03	0.878E 01	0.515	0.191	0.838E 02	0.194E 01	1.88E 00	6.38E-02
115.0	0.967	0.866	0.147E 03	0.822E 01	0.534	0.203	0.829E 02	0.196E 01	1.81E 00	7.16E-02
120.0	0.964	0.855	0.139E 03	0.768E 01	0.554	0.216	0.820E 02	0.200E 01	1.74E 00	8.17E-02
125.0	0.960	0.842	0.131E 03	0.717E 01	0.573	0.230	0.813E 02	0.203E 01	1.68E 00	9.36E-02
130.0	0.956	0.829	0.124E 03	0.670E 01	0.592	0.244	0.806E 02	0.207E 01	1.62E 00	1.07E-01
135.0	0.952	0.814	0.117E 03	0.626E 01	0.613	0.260	0.799E 02	0.211E 01	1.55E 00	1.25E-01
140.0	0.947	0.798	0.111E 03	0.584E 01	0.636	0.280	0.792E 02	0.217E 01	1.49E 00	1.46E-01
145.0	0.941	0.780	0.105E 03	0.544E 01	0.660	0.301	0.787E 02	0.224E 01	1.43E 00	1.73E-01
150.0	0.935	0.760	0.995E 02	0.505E 01	0.685	0.326	0.784E 02	0.232E 01	1.36E 00	2.08E-01
155.0	0.927	0.737	0.940E 02	0.466E 01	0.711	0.354	0.787E 02	0.244E 01	1.30E 00	2.54E-01
160.0	0.917	0.710	0.885E 02	0.427E 01	0.741	0.389	0.787E 02	0.257E 01	1.24E 00	3.22E-01
165.0	0.902	0.671	0.827E 02	0.384E 01	0.787	0.451	0.794E 02	0.284E 01	1.15E 00	4.61E-01
168.9[e]	0.862	0.582			0.862	0.582			1.00E 00	1.00E 00
168.9[f]					0.858	0.573				
55.8[g]	0.975	0.898								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N-PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 290					
0.6	0.100	0.024	0.388E 05	0.584E 03	0.000	0.000	0.114E 03	0.159E 01	2.81E 02	9.00E-01
0.8	0.288	0.083	0.291E 05	0.520E 03	0.001	0.000	0.114E 03	0.159E 01	2.11E 02	7.12E-01
1.0	0.411	0.134	0.233E 05	0.475E 03	0.002	0.000	0.114E 03	0.159E 01	1.69E 02	5.90E-01
1.2	0.493	0.178	0.194E 05	0.436E 03	0.003	0.001	0.114E 03	0.159E 01	1.41E 02	5.08E-01
1.4	0.559	0.220	0.166E 05	0.408E 03	0.005	0.001	0.114E 03	0.159E 01	1.21E 02	4.43E-01
1.6	0.608	0.257	0.145E 05	0.383E 03	0.006	0.001	0.114E 03	0.159E 01	1.06E 02	3.94E-01
1.8	0.652	0.294	0.129E 05	0.364E 03	0.007	0.002	0.114E 03	0.159E 01	9.39E 01	3.50E-01
2.0	0.688	0.329	0.116E 05	0.346E 03	0.008	0.002	0.114E 03	0.159E 01	8.45E 01	3.15E-01
4.0	0.846	0.549	0.582E 04	0.236E 03	0.020	0.004	0.113E 03	0.159E 01	4.25E 01	1.57E-01
6.0	0.897	0.659	0.387E 04	0.177E 03	0.031	0.007	0.113E 03	0.160E 01	2.85E 01	1.07E-01
8.0	0.917	0.712	0.289E 04	0.140E 03	0.043	0.010	0.112E 03	0.160E 01	2.15E 01	8.62E-02
10.0	0.927	0.739	0.230E 04	0.114E 03	0.054	0.012	0.111E 03	0.161E 01	1.73E 01	7.70E-02
12.0	0.935	0.763	0.191E 04	0.971E 02	0.065	0.015	0.111E 03	0.161E 01	1.45E 01	6.92E-02
14.0	0.941	0.779	0.163E 04	0.841E 02	0.075	0.018	0.110E 03	0.162E 01	1.25E 01	6.43E-02
16.0	0.945	0.791	0.142E 04	0.741E 02	0.086	0.020	0.109E 03	0.162E 01	1.10E 01	6.06E-02
18.0	0.947	0.800	0.125E 04	0.661E 02	0.097	0.023	0.109E 03	0.163E 01	9.77E 00	5.83E-02
20.0	0.951	0.811	0.112E 04	0.598E 02	0.107	0.026	0.108E 03	0.163E 01	8.87E 00	5.50E-02
25.0	0.957	0.831	0.889E 03	0.481E 02	0.133	0.033	0.106E 03	0.165E 01	7.18E 00	5.00E-02
30.0	0.960	0.844	0.733E 03	0.401E 02	0.158	0.040	0.105E 03	0.166E 01	6.07E 00	4.70E-02
35.0	0.963	0.853	0.621E 03	0.343E 02	0.183	0.047	0.104E 03	0.168E 01	5.26E 00	4.51E-02
40.0	0.965	0.860	0.537E 03	0.298E 02	0.207	0.055	0.102E 03	0.169E 01	4.67E 00	4.40E-02
45.0	0.966	0.864	0.472E 03	0.263E 02	0.230	0.062	0.101E 03	0.171E 01	4.20E 00	4.40E-02
50.0	0.967	0.866	0.420E 03	0.234E 02	0.253	0.070	0.998E 02	0.172E 01	3.82E 00	4.44E-02
55.0	0.967	0.868	0.377E 03	0.211E 02	0.275	0.078	0.985E 02	0.174E 01	3.51E 00	4.53E-02
60.0	0.967	0.868	0.341E 03	0.191E 02	0.297	0.086	0.973E 02	0.175E 01	3.25E 00	4.65E-02
65.0	0.967	0.868	0.311E 03	0.174E 02	0.319	0.094	0.961E 02	0.177E 01	3.03E 00	4.80E-02
70.0	0.967	0.868	0.286E 03	0.160E 02	0.340	0.103	0.950E 02	0.179E 01	2.85E 00	4.96E-02
75.0	0.967	0.868	0.264E 03	0.147E 02	0.361	0.111	0.939E 02	0.181E 01	2.68E 00	5.12E-02
80.0	0.967	0.868	0.244E 03	0.137E 02	0.381	0.120	0.928E 02	0.183E 01	2.54E 00	5.29E-02
85.0	0.967	0.867	0.227E 03	0.127E 02	0.401	0.130	0.917E 02	0.185E 01	2.41E 00	5.53E-02
90.0	0.966	0.864	0.212E 03	0.118E 02	0.421	0.139	0.906E 02	0.187E 01	2.29E 00	5.83E-02
95.0	0.965	0.861	0.198E 03	0.110E 02	0.441	0.149	0.896E 02	0.189E 01	2.19E 00	6.20E-02
100.0	0.964	0.856	0.186E 03	0.103E 02	0.461	0.160	0.886E 02	0.191E 01	2.09E 00	6.67E-02
105.0	0.962	0.850	0.175E 03	0.964E 01	0.480	0.170	0.877E 02	0.194E 01	2.00E 00	7.24E-02
110.0	0.960	0.843	0.165E 03	0.903E 01	0.500	0.182	0.868E 02	0.197E 01	1.92E 00	7.93E-02
115.0	0.958	0.834	0.156E 03	0.845E 01	0.519	0.193	0.859E 02	0.200E 01	1.85E 00	8.78E-02
120.0	0.955	0.824	0.147E 03	0.791E 01	0.538	0.206	0.851E 02	0.203E 01	1.77E 00	9.82E-02
125.0	0.951	0.812	0.139E 03	0.741E 01	0.558	0.219	0.844E 02	0.207E 01	1.70E 00	1.11E-01
130.0	0.947	0.800	0.132E 03	0.693E 01	0.578	0.234	0.838E 02	0.211E 01	1.64E 00	1.25E-01
135.0	0.943	0.786	0.125E 03	0.649E 01	0.600	0.250	0.820E 02	0.213E 01	1.57E 00	1.43E-01
140.0	0.938	0.771	0.118E 03	0.606E 01	0.624	0.269	0.826E 02	0.222E 01	1.50E 00	1.65E-01
145.0	0.933	0.755	0.112E 03	0.568E 01	0.649	0.291	0.821E 02	0.230E 01	1.44E 00	1.92E-01
150.0	0.926	0.736	0.107E 03	0.528E 01	0.676	0.317	0.817E 02	0.239E 01	1.37E 00	2.29E-01
155.0	0.918	0.713	0.101E 03	0.490E 01	0.704	0.346	0.822E 02	0.252E 01	1.30E 00	2.78E-01
160.0	0.907	0.684	0.955E 02	0.449E 01	0.737	0.383	0.825E 02	0.268E 01	1.23E 00	3.53E-01
165.0[e]	0.888	0.639	0.891E 02	0.399E 01	0.778	0.438	0.838E 02	0.294E 01	1.14E 00	5.04E-01
168.3[f]	0.844	0.547			0.844	0.547			1.00E 00	1.00E 00
168.3[g]					0.830	0.521				
58.7[g]	0.968	0.869								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N–PENTANE
					TEMPERATURE, DEG. K 300					
0.8	0.113	0.027	0.299E 05	0.454E 03	0.000	0.000	0.116E 03	0.161E 01	2.22E 02	8.87E-01
1.0	0.281	0.080	0.239E 05	0.424E 03	0.002	0.000	0.116E 03	0.161E 01	1.78E 02	7.20E-01
1.2	0.393	0.126	0.199E 05	0.398E 03	0.003	0.001	0.116E 03	0.161E 01	1.48E 02	6.08E-01
1.4	0.466	0.163	0.171E 05	0.372E 03	0.004	0.001	0.116E 03	0.161E 01	1.27E 02	5.36E-01
1.6	0.527	0.199	0.150E 05	0.352E 03	0.005	0.001	0.116E 03	0.161E 01	1.11E 02	4.75E-01
1.8	0.575	0.231	0.133E 05	0.333E 03	0.006	0.001	0.116E 03	0.161E 01	9.89E 01	4.28E-01
2.0	0.608	0.256	0.120E 05	0.315E 03	0.007	0.001	0.116E 03	0.162E 01	8.91E 01	3.95E-01
4.0	0.799	0.469	0.600E 04	0.219E 03	0.018	0.004	0.115E 03	0.162E 01	4.47E 01	2.05E-01
6.0	0.857	0.572	0.399E 04	0.166E 03	0.029	0.006	0.115E 03	0.163E 01	3.00E 01	1.47E-01
8.0	0.885	0.630	0.298E 04	0.132E 03	0.039	0.009	0.114E 03	0.163E 01	2.26E 01	1.20E-01
10.0	0.903	0.674	0.238E 04	0.111E 03	0.050	0.011	0.113E 03	0.163E 01	1.81E 01	1.02E-01
12.0	0.917	0.711	0.197E 04	0.954E 02	0.060	0.014	0.113E 03	0.164E 01	1.52E 01	8.83E-02
14.0	0.924	0.731	0.168E 04	0.830E 02	0.071	0.017	0.112E 03	0.164E 01	1.31E 01	8.14E-02
16.0	0.930	0.747	0.147E 04	0.735E 02	0.081	0.019	0.112E 03	0.165E 01	1.15E 01	7.62E-02
18.0	0.934	0.760	0.130E 04	0.658E 02	0.091	0.022	0.111E 03	0.166E 01	1.03E 01	7.22E-02
20.0	0.937	0.769	0.116E 04	0.595E 02	0.101	0.024	0.110E 03	0.166E 01	9.28E 00	6.95E-02
25.0	0.944	0.791	0.921E 03	0.481E 02	0.126	0.031	0.109E 03	0.167E 01	7.50E 00	6.36E-02
30.0	0.949	0.805	0.759E 03	0.402E 02	0.150	0.038	0.108E 03	0.169E 01	6.32E 00	6.00E-02
35.0	0.953	0.818	0.644E 03	0.345E 02	0.174	0.045	0.106E 03	0.170E 01	5.47E 00	5.71E-02
40.0	0.955	0.826	0.557E 03	0.300E 02	0.197	0.052	0.105E 03	0.172E 01	4.84E 00	5.57E-02
45.0	0.957	0.831	0.490E 03	0.265E 02	0.220	0.059	0.104E 03	0.173E 01	4.34E 00	5.56E-02
50.0	0.957	0.833	0.436E 03	0.237E 02	0.243	0.066	0.102E 03	0.175E 01	3.95E 00	5.62E-02
55.0	0.958	0.835	0.392E 03	0.213E 02	0.264	0.074	0.101E 03	0.176E 01	3.62E 00	5.73E-02
60.0	0.958	0.835	0.356E 03	0.193E 02	0.286	0.082	0.999E 02	0.178E 01	3.35E 00	5.88E-02
65.0	0.958	0.835	0.325E 03	0.177E 02	0.307	0.089	0.987E 02	0.180E 01	3.12E 00	6.06E-02
70.0	0.958	0.835	0.298E 03	0.162E 02	0.327	0.098	0.979E 02	0.182E 01	2.93E 00	6.26E-02
75.0	0.958	0.835	0.276E 03	0.150E 02	0.347	0.106	0.966E 02	0.183E 01	2.76E 00	6.44E-02
80.0	0.958	0.834	0.256E 03	0.139E 02	0.367	0.114	0.956E 02	0.185E 01	2.61E 00	6.67E-02
85.0	0.957	0.833	0.238E 03	0.129E 02	0.387	0.123	0.945E 02	0.187E 01	2.47E 00	6.95E-02
90.0	0.957	0.831	0.222E 03	0.120E 02	0.406	0.132	0.935E 02	0.190E 01	2.35E 00	7.29E-02
95.0	0.956	0.828	0.208E 03	0.112E 02	0.426	0.142	0.926E 02	0.192E 01	2.24E 00	7.68E-02
100.0	0.954	0.824	0.196E 03	0.105E 02	0.446	0.152	0.916E 02	0.194E 01	2.14E 00	8.20E-02
105.0	0.953	0.817	0.184E 03	0.985E 01	0.465	0.162	0.907E 02	0.197E 01	2.05E 00	8.85E-02
110.0	0.951	0.810	0.174E 03	0.923E 01	0.485	0.173	0.898E 02	0.200E 01	1.96E 00	9.59E-02
115.0	0.948	0.802	0.164E 03	0.865E 01	0.505	0.185	0.890E 02	0.203E 01	1.88E 00	1.05E-01
120.0	0.945	0.793	0.155E 03	0.811E 01	0.525	0.197	0.882E 02	0.206E 01	1.80E 00	1.15E-01
125.0	0.942	0.782	0.147E 03	0.760E 01	0.545	0.210	0.876E 02	0.211E 01	1.73E 00	1.28E-01
130.0	0.938	0.770	0.139E 03	0.713E 01	0.566	0.225	0.844E 02	0.209E 01	1.66E 00	1.44E-01
135.0	0.933	0.756	0.132E 03	0.668E 01	0.588	0.241	0.864E 02	0.221E 01	1.59E 00	1.62E-01
140.0	0.928	0.742	0.126E 03	0.626E 01	0.612	0.260	0.860E 02	0.227E 01	1.52E 00	1.85E-01
145.0	0.922	0.725	0.119E 03	0.585E 01	0.638	0.281	0.857E 02	0.236E 01	1.45E 00	2.14E-01
150.0	0.915	0.705	0.113E 03	0.545E 01	0.667	0.308	0.854E 02	0.246E 01	1.37E 00	2.55E-01
155.0	0.906	0.681	0.107E 03	0.503E 01	0.698	0.340	0.857E 02	0.260E 01	1.30E 00	3.13E-01
160.0	0.893	0.649	0.101E 03	0.460E 01	0.732	0.378	0.865E 02	0.278E 01	1.22E 00	4.00E-01
165.0[e]	0.870	0.599	0.945E 02	0.405E 01	0.778	0.438	0.886E 02	0.311E 01	1.12E 00	5.83E-01
167.7[f]	0.830	0.521			0.830	0.521			1.00E 00	1.00E 00
166.4					0.797	0.466				
61.6[g]	0.958	0.835								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N-PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 310					
1.2	0.168	0.043	0.203E 05	0.324E 03	0.001	0.000	0.118E 03	0.164E 01	1.57E 02	8.33E-01
1.4	0.280	0.080	0.175E 05	0.309E 03	0.002	0.000	0.118E 03	0.164E 01	1.35E 02	7.21E-01
1.6	0.364	0.113	0.153E 05	0.296E 03	0.003	0.001	0.118E 03	0.164E 01	1.18E 02	6.37E-01
1.8	0.430	0.144	0.136E 05	0.283E 03	0.004	0.001	0.118E 03	0.164E 01	1.05E 02	5.72E-01
2.0	0.483	0.172	0.122E 05	0.272E 03	0.005	0.001	0.118E 03	0.164E 01	9.42E 01	5.20E-01
4.0	0.717	0.360	0.615E 04	0.193E 03	0.015	0.003	0.117E 03	0.165E 01	4.73E 01	2.87E-01
6.0	0.803	0.476	0.410E 04	0.151E 03	0.025	0.006	0.117E 03	0.165E 01	3.16E 01	2.02E-01
8.0	0.843	0.545	0.307E 04	0.123E 03	0.035	0.008	0.116E 03	0.166E 01	2.38E 01	1.62E-01
10.0	0.866	0.590	0.245E 04	0.104E 03	0.045	0.010	0.116E 03	0.166E 01	1.91E 01	1.40E-01
12.0	0.886	0.633	0.203E 04	0.905E 02	0.055	0.013	0.115E 03	0.167E 01	1.60E 01	1.21E-01
14.0	0.897	0.660	0.174E 04	0.796E 02	0.065	0.015	0.115E 03	0.167E 01	1.37E 01	1.10E-01
16.0	0.906	0.683	0.151E 04	0.711E 02	0.076	0.018	0.114E 03	0.168E 01	1.20E 01	1.01E-01
18.0	0.914	0.702	0.134E 04	0.642E 02	0.085	0.020	0.113E 03	0.167E 01	1.07E 01	9.44E-02
20.0	0.919	0.716	0.120E 04	0.584E 02	0.095	0.023	0.113E 03	0.169E 01	9.69E 00	8.95E-02
25.0	0.929	0.744	0.952E 03	0.475E 02	0.119	0.029	0.111E 03	0.170E 01	7.82E 00	8.08E-02
30.0	0.935	0.763	0.786E 03	0.400E 02	0.142	0.036	0.110E 03	0.172E 01	6.56E 00	7.53E-02
35.0	0.940	0.777	0.667E 03	0.344E 02	0.166	0.042	0.109E 03	0.173E 01	5.67E 00	7.20E-02
40.0	0.943	0.787	0.578E 03	0.301E 02	0.189	0.049	0.107E 03	0.174E 01	5.00E 00	7.00E-02
45.0	0.945	0.792	0.509E 03	0.266E 02	0.211	0.056	0.106E 03	0.176E 01	4.48E 00	6.98E-02
50.0	0.946	0.796	0.453E 03	0.238E 02	0.233	0.063	0.105E 03	0.177E 01	4.06E 00	7.04E-02
55.0	0.947	0.798	0.408E 03	0.214E 02	0.254	0.070	0.104E 03	0.179E 01	3.72E 00	7.16E-02
60.0	0.947	0.798	0.370E 03	0.195E 02	0.276	0.078	0.102E 03	0.181E 01	3.44E 00	7.33E-02
65.0	0.947	0.799	0.338E 03	0.178E 02	0.296	0.086	0.101E 03	0.183E 01	3.20E 00	7.52E-02
70.0	0.947	0.799	0.311E 03	0.164E 02	0.317	0.093	0.100E 03	0.184E 01	2.99E 00	7.74E-02
75.0	0.947	0.799	0.287E 03	0.151E 02	0.336	0.101	0.992E 02	0.186E 01	2.82E 00	7.99E-02
80.0	0.947	0.798	0.267E 03	0.140E 02	0.356	0.109	0.982E 02	0.188E 01	2.66E 00	8.27E-02
85.0	0.946	0.796	0.249E 03	0.130E 02	0.375	0.118	0.972E 02	0.190E 01	2.52E 00	8.61E-02
90.0	0.945	0.794	0.232E 03	0.122E 02	0.394	0.126	0.963E 02	0.192E 01	2.40E 00	9.00E-02
95.0	0.944	0.791	0.218E 03	0.114E 02	0.414	0.136	0.954E 02	0.195E 01	2.28E 00	9.46E-02
100.0	0.943	0.787	0.205E 03	0.106E 02	0.433	0.145	0.945E 02	0.197E 01	2.18E 00	1.00E-01
105.0	0.941	0.782	0.193E 03	0.998E 01	0.452	0.155	0.936E 02	0.200E 01	2.08E 00	1.07E-01
110.0	0.939	0.774	0.182E 03	0.935E 01	0.471	0.165	0.928E 02	0.203E 01	1.99E 00	1.15E-01
115.0	0.937	0.767	0.172E 03	0.878E 01	0.491	0.177	0.921E 02	0.206E 01	1.91E 00	1.24E-01
120.0	0.934	0.758	0.163E 03	0.824E 01	0.511	0.189	0.913E 02	0.210E 01	1.83E 00	1.36E-01
125.0	0.930	0.749	0.155E 03	0.775E 01	0.532	0.202	0.907E 02	0.214E 01	1.75E 00	1.48E-01
130.0	0.926	0.737	0.147E 03	0.727E 01	0.553	0.216	0.902E 02	0.219E 01	1.67E 00	1.65E-01
135.0	0.922	0.724	0.139E 03	0.682E 01	0.576	0.232	0.897E 02	0.225E 01	1.60E 00	1.84E-01
140.0	0.916	0.708	0.133E 03	0.639E 01	0.599	0.250	0.896E 02	0.232E 01	1.53E 00	2.09E-01
145.0	0.910	0.691	0.126E 03	0.597E 01	0.626	0.271	0.895E 02	0.241E 01	1.45E 00	2.41E-01
150.0	0.901	0.670	0.120E 03	0.555E 01	0.657	0.299	0.894E 02	0.253E 01	1.37E 00	2.88E-01
155.0	0.891	0.645	0.113E 03	0.512E 01	0.691	0.332	0.903E 02	0.270E 01	1.29E 00	3.52E-01
160.0	0.877	0.614	0.107E 03	0.468E 01	0.729	0.375	0.915E 02	0.293E 01	1.20E 00	4.53E-01
165.0	0.853	0.563	0.100E 03	0.412E 01	0.779	0.440	0.946E 02	0.333E 01	1.09E 00	6.67E-01
166.7[e]	0.819	0.502			0.819	0.502			1.00E 00	1.00E 00
162.8[f]					0.752	0.403				
64.5[g]	0.947	0.799								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 320					
1.6	0.0944	0.0227	1.552E 04	2.322E 02	0.0008	0.0002	1.207E 02	1.674E 00	1.223E 02	9.062E-01
1.8	0.1903	0.0497	1.382E 04	2.248E 02	0.0018	0.0004	1.206E 02	1.674E 00	1.087E 02	8.111E-01
2.0	0.2670	0.0749	1.245E 04	2.177E 02	0.0027	0.0006	1.206E 02	1.675E 00	9.788E 01	7.350E-01
4.0	0.6149	0.2620	6.277E 03	1.667E 02	0.0125	0.0028	1.199E 02	1.678E 00	4.906E 01	3.900E-01
6.0	0.7361	0.3827	4.191E 03	1.359E 02	0.0224	0.0051	1.193E 02	1.682E 00	3.279E 01	2.700E-01
8.0	0.7895	0.4547	3.143E 03	1.128E 02	0.0320	0.0073	1.187E 02	1.687E 00	2.465E 01	2.175E-01
10.0	0.8246	0.5111	2.510E 03	9.699E 01	0.0417	0.0096	1.181E 02	1.691E 00	1.977E 01	1.830E-01
12.0	0.8458	0.5495	2.086E 03	8.448E 01	0.0512	0.0119	1.175E 02	1.696E 00	1.652E 01	1.625E-01
14.0	0.8611	0.5796	1.783E 03	7.480E 01	0.0607	0.0142	1.170E 02	1.701E 00	1.419E 01	1.479E-01
16.0	0.8739	0.6064	1.556E 03	6.730E 01	0.0702	0.0165	1.164E 02	1.706E 00	1.245E 01	1.356E-01
18.0	0.8850	0.6311	1.379E 03	6.130E 01	0.0798	0.0189	1.158E 02	1.712E 00	1.109E 01	1.250E-01
20.0	0.8944	0.6531	1.238E 03	5.633E 01	0.0893	0.0213	1.153E 02	1.717E 00	1.001E 01	1.160E-01
25.0	0.9084	0.6881	9.823E 02	4.638E 01	0.1127	0.0275	1.139E 02	1.731E 00	8.064E 00	1.032E-01
30.0	0.9176	0.7123	8.120E 02	3.929E 01	0.1357	0.0337	1.126E 02	1.745E 00	6.764E 00	9.533E-02
35.0	0.9243	0.7307	6.902E 02	3.401E 01	0.1585	0.0402	1.113E 02	1.760E 00	5.833E 00	9.000E-02
40.0	0.9289	0.7440	5.987E 02	2.989E 01	0.1809	0.0468	1.101E 02	1.775E 00	5.135E 00	8.675E-02
45.0	0.9316	0.7518	5.273E 02	2.652E 01	0.2028	0.0535	1.088E 02	1.790E 00	4.595E 00	8.578E-02
50.0	0.9328	0.7553	4.700E 02	2.372E 01	0.2240	0.0603	1.076E 02	1.805E 00	4.164E 00	8.660E-02
55.0	0.9337	0.7579	4.233E 02	2.142E 01	0.2450	0.0673	1.064E 02	1.822E 00	3.811E 00	8.782E-02
60.0	0.9341	0.7593	3.843E 02	1.947E 01	0.2655	0.0744	1.052E 02	1.837E 00	3.518E 00	8.967E-02
65.0	0.9344	0.7600	3.514E 02	1.781E 01	0.2856	0.0816	1.041E 02	1.854E 00	3.272E 00	9.185E-02
70.0	0.9344	0.7600	3.233E 02	1.639E 01	0.3052	0.0890	1.030E 02	1.872E 00	3.061E 00	9.443E-02
75.0	0.9344	0.7599	2.990E 02	1.516E 01	0.3247	0.0966	1.020E 02	1.890E 00	2.878E 00	9.720E-02
80.0	0.9340	0.7590	2.777E 02	1.406E 01	0.3438	0.1043	1.010E 02	1.910E 00	2.717E 00	1.005E-01
85.0	0.9337	0.7580	2.590E 02	1.310E 01	0.3627	0.1123	1.001E 02	1.933E 00	2.574E 00	1.040E-01
90.0	0.9329	0.7557	2.422E 02	1.223E 01	0.3817	0.1207	9.920E 01	1.955E 00	2.444E 00	1.084E-01
95.0	0.9318	0.7525	2.272E 02	1.143E 01	0.4004	0.1293	9.833E 01	1.979E 00	2.327E 00	1.137E-01
100.0	0.9303	0.7481	2.135E 02	1.070E 01	0.4195	0.1384	9.751E 01	2.006E 00	2.218E 00	1.200E-01
105.0	0.9283	0.7422	2.011E 02	1.002E 01	0.4387	0.1480	9.672E 01	2.035E 00	2.116E 00	1.277E-01
110.0	0.9258	0.7350	1.899E 02	9.397E 00	0.4582	0.1583	9.596E 01	2.066E 00	2.020E 00	1.370E-01
115.0	0.9230	0.7271	1.795E 02	8.815E 00	0.4780	0.1692	9.526E 01	2.101E 00	1.931E 00	1.476E-01
120.0	0.9198	0.7184	1.701E 02	8.280E 00	0.4983	0.1809	9.449E 01	2.138E 00	1.846E 00	1.598E-01
125.0	0.9162	0.7087	1.614E 02	7.780E 00	0.5193	0.1937	9.385E 01	2.182E 00	1.764E 00	1.742E-01
130.0	0.9119	0.6970	1.532E 02	7.302E 00	0.5417	0.2081	9.337E 01	2.236E 00	1.683E 00	1.923E-01
135.0	0.9066	0.6835	1.456E 02	6.842E 00	0.5653	0.2243	9.302E 01	2.300E 00	1.604E 00	2.147E-01
140.0	0.9010	0.6693	1.385E 02	6.412E 00	0.5900	0.2424	9.300E 01	2.382E 00	1.527E 00	2.414E-01
145.0	0.8941	0.6525	1.317E 02	5.990E 00	0.6185	0.2650	9.292E 01	2.482E 00	1.445E 00	2.776E-01
150.0	0.8860	0.6334	1.252E 02	5.578E 00	0.6493	0.2916	9.348E 01	2.617E 00	1.365E 00	3.251E-01
155.0	0.8756	0.6102	1.188E 02	5.161E 00	0.6848	0.3257	9.477E 01	2.810E 00	1.279E 00	3.946E-01
160.0	0.8612	0.5797	1.123E 02	4.714E 00	0.7272	0.3721	9.696E 01	3.093E 00	1.184E 00	5.089E-01
165.0[e]	0.8267	0.5146	1.038E 02	4.028E 00	0.7962	0.4649	1.016E 02	3.699E 00	1.038E 00	8.508E-01
165.3[f]	0.808	0.484	0.103E 03	0.384E 01	0.808	0.484	0.103E 03	0.384E 01	1.000E 00	1.000E 00
157.5[f]					0.703	0.345				
67.3[g]	0.934	0.760								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N–PENTANE
					TEMPERATURE, DEG. K 330					
2.0	0.0404	0.0093	1.263E 04	1.808E 02	0.0004	0.0001	1.230E 02	1.706E 00	1.008E 02	9.600E-01
4.0	0.5050	0.1849	6.388E 03	1.458E 02	0.0100	0.0022	1.224E 02	1.710E 00	5.051E 01	5.000E-01
6.0	0.6585	0.3001	4.274E 03	1.214E 02	0.0195	0.0044	1.218E 02	1.714E 00	3.376E 01	3.483E-01
8.0	0.7329	0.3790	3.212E 03	1.035E 02	0.0289	0.0066	1.212E 02	1.718E 00	2.537E 01	2.750E-01
10.0	0.7778	0.4377	2.569E 03	9.010E 01	0.0382	0.0088	1.207E 02	1.724E 00	2.034E 01	2.310E-01
12.0	0.8095	0.4859	2.138E 03	7.997E 01	0.0476	0.0110	1.201E 02	1.728E 00	1.699E 01	2.000E-01
14.0	0.8282	0.5173	1.829E 03	7.122E 01	0.0567	0.0132	1.196E 02	1.734E 00	1.460E 01	1.821E-01
16.0	0.8447	0.5475	1.598E 03	6.455E 01	0.0661	0.0155	1.190E 02	1.738E 00	1.279E 01	1.662E-01
18.0	0.8561	0.5695	1.420E 03	5.888E 01	0.0751	0.0177	1.184E 02	1.743E 00	1.140E 01	1.556E-01
20.0	0.8654	0.5883	1.272E 03	5.391E 01	0.0841	0.0200	1.179E 02	1.749E 00	1.029E 01	1.470E-01
25.0	0.8831	0.6268	1.010E 03	4.468E 01	0.1062	0.0257	1.166E 02	1.762E 00	8.313E 00	1.308E-01
30.0	0.8946	0.6537	8.371E 02	3.813E 01	0.1290	0.0319	1.152E 02	1.775E 00	6.933E 00	1.210E-01
35.0	0.9030	0.6742	7.117E 02	3.312E 01	0.1511	0.0381	1.140E 02	1.790E 00	5.976E 00	1.143E-01
40.0	0.9088	0.6891	6.179E 02	2.920E 01	0.1729	0.0444	1.127E 02	1.805E 00	5.256E 00	1.102E-01
45.0	0.9132	0.7005	5.447E 02	2.604E 01	0.1943	0.0509	1.115E 02	1.820E 00	4.699E 00	1.078E-01
50.0	0.9162	0.7086	4.861E 02	2.344E 01	0.2155	0.0576	1.102E 02	1.835E 00	4.251E 00	1.068E-01
55.0	0.9178	0.7128	4.379E 02	2.120E 01	0.2362	0.0643	1.090E 02	1.851E 00	3.886E 00	1.076E-01
60.0	0.9186	0.7150	3.978E 02	1.930E 01	0.2564	0.0712	1.079E 02	1.868E 00	3.583E 00	1.095E-01
65.0	0.9192	0.7166	3.639E 02	1.768E 01	0.2763	0.0782	1.068E 02	1.885E 00	3.327E 00	1.117E-01
70.0	0.9193	0.7170	3.350E 02	1.628E 01	0.2957	0.0854	1.058E 02	1.903E 00	3.109E 00	1.146E-01
75.0	0.9193	0.7170	3.098E 02	1.506E 01	0.3146	0.0926	1.048E 02	1.923E 00	2.922E 00	1.177E-01
80.0	0.9193	0.7171	2.878E 02	1.399E 01	0.3334	0.1001	1.039E 02	1.944E 00	2.757E 00	1.210E-01
85.0	0.9190	0.7162	2.683E 02	1.303E 01	0.3518	0.1077	1.030E 02	1.966E 00	2.612E 00	1.249E-01
90.0	0.9184	0.7144	2.510E 02	1.217E 01	0.3700	0.1155	1.022E 02	1.989E 00	2.482E 00	1.296E-01
95.0	0.9173	0.7115	2.356E 02	1.139E 01	0.3886	0.1238	1.014E 02	2.013E 00	2.361E 00	1.353E-01
100.0	0.9155	0.7066	2.215E 02	1.066E 01	0.4069	0.1323	1.007E 02	2.041E 00	2.250E 00	1.425E-01
105.0	0.9130	0.7001	2.086E 02	9.973E 00	0.4257	0.1415	9.997E 01	2.071E 00	2.145E 00	1.514E-01
110.0	0.9103	0.6929	1.970E 02	9.345E 00	0.4444	0.1510	9.939E 01	2.105E 00	2.048E 00	1.614E-01
115.0	0.9071	0.6846	1.864E 02	8.767E 00	0.4638	0.1613	9.877E 01	2.141E 00	1.956E 00	1.733E-01
120.0	0.9036	0.6757	1.766E 02	8.233E 00	0.4861	0.1738	9.797E 01	2.183E 00	1.859E 00	1.877E-01
125.0	0.8996	0.6658	1.675E 02	7.727E 00	0.5087	0.1871	9.725E 01	2.230E 00	1.768E 00	2.044E-01
130.0	0.8945	0.6535	1.591E 02	7.244E 00	0.5313	0.2013	9.674E 01	2.285E 00	1.684E 00	2.250E-01
135.0	0.8889	0.6402	1.512E 02	6.788E 00	0.5550	0.2171	9.664E 01	2.357E 00	1.602E 00	2.496E-01
140.0	0.8827	0.6258	1.438E 02	6.357E 00	0.5813	0.2359	9.666E 01	2.445E 00	1.518E 00	2.802E-01
145.0	0.8755	0.6099	1.369E 02	5.943E 00	0.6087	0.2570	9.716E 01	2.557E 00	1.438E 00	3.182E-01
150.0	0.8671	0.5920	1.302E 02	5.541E 00	0.6397	0.2830	9.784E 01	2.698E 00	1.356E 00	3.687E-01
155.0	0.8560	0.5692	1.235E 02	5.119E 00	0.6816	0.3225	9.926E 01	2.927E 00	1.256E 00	4.524E-01
160.0[e]	0.8373	0.5336	1.164E 02	4.625E 00	0.7317	0.3775	1.016E 02	3.268E 00	1.144E 00	6.067E-01
163.4[f]	0.797	0.466	0.107E 03	0.391E 01	0.797	0.466	0.107E 03	0.391E 01	1.000E 00	1.000E 00
151.5[f]					0.652	0.294				
70.2[g]	0.919	0.717								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE-N-PENTANE SYSTEM - CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 340					
4.0	0.3896	0.1243	6.482E 03	1.289E 02	0.0075	0.0017	1.250E 02	1.743E 00	5.166E 01	6.150E-01
6.0	0.5739	0.2304	4.357E 03	1.091E 02	0.0166	0.0037	1.244E 02	1.747E 00	3.450E 01	4.333E-01
8.0	0.6700	0.3110	3.271E 03	9.466E 01	0.0259	0.0059	1.239E 02	1.752E 00	2.592E 01	3.387E-01
10.0	0.7210	0.3650	2.619E 03	8.262E 01	0.0347	0.0079	1.233E 02	1.757E 00	2.075E 01	2.890E-01
12.0	0.7602	0.4134	2.184E 03	7.403E 01	0.0439	0.0101	1.227E 02	1.760E 00	1.733E 01	2.508E-01
14.0	0.7869	0.4509	1.870E 03	6.680E 01	0.0529	0.0123	1.221E 02	1.765E 00	1.488E 01	2.250E-01
16.0	0.8089	0.4848	1.638E 03	6.119E 01	0.0620	0.0145	1.215E 02	1.770E 00	1.304E 01	2.037E-01
18.0	0.8230	0.5082	1.454E 03	5.598E 01	0.0709	0.0167	1.210E 02	1.775E 00	1.161E 01	1.906E-01
20.0	0.8343	0.5283	1.306E 03	5.155E 01	0.0797	0.0189	1.205E 02	1.780E 00	1.047E 01	1.800E-01
25.0	0.8556	0.5684	1.038E 03	4.300E 01	0.1017	0.0246	1.192E 02	1.794E 00	8.410E 00	1.608E-01
30.0	0.8703	0.5987	8.598E 02	3.687E 01	0.1236	0.0304	1.179E 02	1.807E 00	7.039E 00	1.480E-01
35.0	0.8798	0.6195	7.320E 02	3.212E 01	0.1452	0.0364	1.166E 02	1.822E 00	6.059E 00	1.406E-01
40.0	0.8871	0.6359	6.357E 02	2.841E 01	0.1666	0.0426	1.154E 02	1.838E 00	5.325E 00	1.355E-01
45.0	0.8926	0.6489	5.609E 02	2.542E 01	0.1878	0.0489	1.142E 02	1.853E 00	4.753E 00	1.322E-01
50.0	0.8960	0.6570	5.009E 02	2.289E 01	0.2085	0.0553	1.131E 02	1.871E 00	4.298E 00	1.314E-01
55.0	0.8983	0.6627	4.516E 02	2.077E 01	0.2287	0.0619	1.119E 02	1.886E 00	3.927E 00	1.318E-01
60.0	0.8998	0.6663	4.106E 02	1.895E 01	0.2485	0.0685	1.108E 02	1.903E 00	3.620E 00	1.333E-01
65.0	0.9006	0.6684	3.758E 02	1.738E 01	0.2678	0.0752	1.098E 02	1.922E 00	3.363E 00	1.357E-01
70.0	0.9009	0.6691	3.458E 02	1.601E 01	0.2867	0.0820	1.088E 02	1.940E 00	3.143E 00	1.389E-01
75.0	0.9009	0.6690	3.198E 02	1.480E 01	0.3052	0.0890	1.079E 02	1.960E 00	2.952E 00	1.427E-01
80.0	0.9009	0.6691	2.970E 02	1.375E 01	0.3232	0.0960	1.070E 02	1.981E 00	2.787E 00	1.464E-01
85.0	0.9008	0.6687	2.770E 02	1.282E 01	0.3415	0.1034	1.062E 02	2.004E 00	2.637E 00	1.507E-01
90.0	0.9002	0.6674	2.591E 02	1.197E 01	0.3596	0.1110	1.054E 02	2.028E 00	2.504E 00	1.558E-01
95.0	0.8994	0.6652	2.430E 02	1.121E 01	0.3776	0.1189	1.047E 02	2.054E 00	2.382E 00	1.617E-01
100.0	0.8976	0.6608	2.285E 02	1.049E 01	0.3957	0.1271	1.040E 02	2.082E 00	2.268E 00	1.695E-01
105.0	0.8955	0.6559	2.154E 02	9.832E 00	0.4143	0.1359	1.033E 02	2.113E 00	2.162E 00	1.784E-01
110.0	0.8925	0.6486	2.035E 02	9.216E 00	0.4335	0.1454	1.027E 02	2.148E 00	2.059E 00	1.898E-01
115.0	0.8890	0.6405	1.926E 02	8.647E 00	0.4537	0.1559	1.021E 02	2.186E 00	1.959E 00	2.031E-01
120.0	0.8850	0.6311	1.824E 02	8.106E 00	0.4757	0.1679	1.014E 02	2.231E 00	1.860E 00	2.194E-01
125.0	0.8802	0.6204	1.730E 02	7.601E 00	0.4988	0.1812	1.008E 02	2.282E 00	1.765E 00	2.390E-01
130.0	0.8743	0.6074	1.641E 02	7.108E 00	0.5223	0.1955	1.003E 02	2.340E 00	1.674E 00	2.631E-01
135.0	0.8678	0.5934	1.558E 02	6.642E 00	0.5469	0.2116	1.001E 02	2.414E 00	1.587E 00	2.918E-01
140.0	0.8596	0.5765	1.479E 02	6.183E 00	0.5736	0.2303	1.001E 02	2.505E 00	1.499E 00	3.293E-01
145.0	0.8505	0.5585	1.405E 02	5.753E 00	0.6012	0.2510	1.010E 02	2.629E 00	1.415E 00	3.749E-01
150.0	0.8389	0.5366	1.332E 02	5.312E 00	0.6368	0.2805	1.025E 02	2.814E 00	1.317E 00	4.435E-01
155.0	0.8232	0.5087	1.259E 02	4.847E 00	0.6818	0.3227	1.049E 02	3.094E 00	1.207E 00	5.557E-01
160.0[e]	0.7914	0.4576	1.172E 02	4.224E 00	0.7452	0.3940	1.097E 02	3.615E 00	1.062E 00	8.187E-01
160.7[f]	0.777	0.436	0.114E 03	0.399E 01	0.777	0.436	0.114E 03	0.399E 01	1.000E 00	1.000E 00
144.9[g]					0.600	0.250				
72.9[g]	0.901	0.669								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 350					
4.0	0.1652	0.0421	6.494E 03	1.033E 02	0.0032	0.0007	1.279E 02	1.777E 00	5.212E 01	8.375E-01
6.0	0.4388	0.1481	4.382E 03	9.220E 01	0.0126	0.0028	1.272E 02	1.781E 00	3.480E 01	5.683E-01
8.0	0.5634	0.2229	3.307E 03	8.156E 01	0.0216	0.0049	1.266E 02	1.785E 00	2.613E 01	4.462E-01
10.0	0.6453	0.2880	2.656E 03	7.388E 01	0.0308	0.0070	1.260E 02	1.790E 00	2.094E 01	3.660E-01
12.0	0.6943	0.3356	2.217E 03	6.680E 01	0.0397	0.0091	1.255E 02	1.795E 00	1.747E 01	3.183E-01
14.0	0.7282	0.3733	1.903E 03	6.081E 01	0.0485	0.0112	1.249E 02	1.799E 00	1.500E 01	2.857E-01
16.0	0.7537	0.4049	1.664E 03	5.574E 01	0.0573	0.0133	1.243E 02	1.804E 00	1.314E 01	2.612E-01
18.0	0.7754	0.4343	1.479E 03	5.164E 01	0.0663	0.0155	1.238E 02	1.809E 00	1.170E 01	2.406E-01
20.0	0.7919	0.4583	1.331E 03	4.801E 01	0.0751	0.0177	1.232E 02	1.814E 00	1.055E 01	2.250E-01
25.0	0.8197	0.5027	1.061E 03	4.056E 01	0.0968	0.0233	1.220E 02	1.829E 00	8.470E 00	1.996E-01
30.0	0.8396	0.5378	8.801E 02	3.514E 01	0.1185	0.0290	1.206E 02	1.842E 00	7.084E 00	1.820E-01
35.0	0.8518	0.5610	7.500E 02	3.079E 01	0.1397	0.0349	1.194E 02	1.857E 00	6.096E 00	1.723E-01
40.0	0.8598	0.5769	6.519E 02	2.726E 01	0.1606	0.0408	1.183E 02	1.873E 00	5.355E 00	1.670E-01
45.0	0.8661	0.5899	5.753E 02	2.442E 01	0.1813	0.0469	1.171E 02	1.890E 00	4.777E 00	1.636E-01
50.0	0.8712	0.6006	5.138E 02	2.208E 01	0.2018	0.0532	1.160E 02	1.907E 00	4.317E 00	1.614E-01
55.0	0.8742	0.6072	4.633E 02	2.006E 01	0.2219	0.0596	1.149E 02	1.925E 00	3.939E 00	1.616E-01
60.0	0.8765	0.6122	4.213E 02	1.834E 01	0.2417	0.0662	1.139E 02	1.943E 00	3.627E 00	1.628E-01
65.0	0.8780	0.6154	3.857E 02	1.685E 01	0.2609	0.0728	1.128E 02	1.962E 00	3.365E 00	1.651E-01
70.0	0.8786	0.6168	3.549E 02	1.553E 01	0.2795	0.0794	1.119E 02	1.981E 00	3.144E 00	1.684E-01
75.0	0.8788	0.6171	3.282E 02	1.436E 01	0.2974	0.0860	1.110E 02	2.002E 00	2.955E 00	1.725E-01
80.0	0.8787	0.6170	3.048E 02	1.334E 01	0.3152	0.0929	1.103E 02	2.025E 00	2.787E 00	1.771E-01
85.0	0.8787	0.6170	2.842E 02	1.244E 01	0.3331	0.1000	1.095E 02	2.048E 00	2.638E 00	1.819E-01
90.0	0.8782	0.6158	2.658E 02	1.162E 01	0.3511	0.1074	1.088E 02	2.075E 00	2.501E 00	1.878E-01
95.0	0.8770	0.6133	2.493E 02	1.087E 01	0.3693	0.1152	1.082E 02	2.104E 00	2.375E 00	1.949E-01
100.0	0.8752	0.6094	2.347E 02	1.018E 01	0.3873	0.1232	1.076E 02	2.133E 00	2.260E 00	2.036E-01
105.0	0.8733	0.6051	2.212E 02	9.553E 00	0.4059	0.1319	1.069E 02	2.165E 00	2.151E 00	2.133E-01
110.0	0.8709	0.5999	2.089E 02	8.970E 00	0.4254	0.1413	1.063E 02	2.202E 00	2.047E 00	2.247E-01
115.0	0.8680	0.5938	1.978E 02	8.433E 00	0.4461	0.1519	1.058E 02	2.245E 00	1.946E 00	2.383E-01
120.0	0.8637	0.5849	1.874E 02	7.912E 00	0.4670	0.1630	1.054E 02	2.294E 00	1.850E 00	2.557E-01
125.0	0.8588	0.5749	1.777E 02	7.415E 00	0.4899	0.1760	1.049E 02	2.349E 00	1.753E 00	2.768E-01
130.0	0.8525	0.5624	1.687E 02	6.936E 00	0.5135	0.1901	1.045E 02	2.411E 00	1.660E 00	3.032E-01
135.0	0.8450	0.5480	1.601E 02	6.471E 00	0.5400	0.2070	1.033E 02	2.467E 00	1.565E 00	3.369E-01
140.0	0.8359	0.5311	1.519E 02	6.014E 00	0.5691	0.2270	1.038E 02	2.581E 00	1.469E 00	3.808E-01
145.0	0.8249	0.5115	1.440E 02	5.565E 00	0.6012	0.2510	1.052E 02	2.739E 00	1.372E 00	4.391E-01
150.0	0.8096	0.4860	1.361E 02	5.092E 00	0.6391	0.2825	1.076E 02	2.965E 00	1.267E 00	5.275E-01
155.0	0.7766	0.4359	1.266E 02	4.429E 00	0.6919	0.3330	1.121E 02	3.364E 00	1.122E 00	7.252E-01
157.0[e]	0.754	0.405	0.120E 03	0.403E 01	0.754	0.405	0.120E 03	0.403E 01	1.000E 00	1.000E 00
137.8[f]					0.555	0.217				
75.1[g]	0.879	0.617								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE-N-PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 360					
6.0	0.2741	0.0775	4.376E 03	7.708E 01	0.0079	0.0018	1.303E 02	1.817E 00	3.474E 01	7.317E-01
8.0	0.4496	0.1537	3.321E 03	7.078E 01	0.0172	0.0039	1.297E 02	1.822E 00	2.610E 01	5.600E-01
10.0	0.5512	0.2145	2.676E 03	6.490E 01	0.0264	0.0060	1.291E 02	1.827E 00	2.090E 01	4.610E-01
12.0	0.6141	0.2613	2.239E 03	5.939E 01	0.0352	0.0080	1.285E 02	1.832E 00	1.745E 01	4.000E-01
14.0	0.6593	0.3008	1.925E 03	5.473E 01	0.0440	0.0101	1.280E 02	1.837E 00	1.497E 01	3.564E-01
16.0	0.6921	0.3333	1.688E 03	5.065E 01	0.0527	0.0122	1.275E 02	1.842E 00	1.312E 01	3.250E-01
18.0	0.7185	0.3620	1.502E 03	4.717E 01	0.0615	0.0144	1.269E 02	1.847E 00	1.168E 01	3.000E-01
20.0	0.7368	0.3836	1.351E 03	4.385E 01	0.0699	0.0164	1.264E 02	1.852E 00	1.053E 01	2.830E-01
25.0	0.7728	0.4307	1.078E 03	3.746E 01	0.0914	0.0219	1.251E 02	1.867E 00	8.457E 00	2.500E-01
30.0	0.7959	0.4644	8.952E 02	3.256E 01	0.1125	0.0274	1.239E 02	1.882E 00	7.073E 00	2.300E-01
35.0	0.8144	0.4938	7.642E 02	2.889E 01	0.1338	0.0332	1.226E 02	1.897E 00	6.085E 00	2.143E-01
40.0	0.8276	0.5163	6.653E 02	2.587E 01	0.1549	0.0392	1.214E 02	1.913E 00	5.342E 00	2.040E-01
45.0	0.8362	0.5316	5.874E 02	2.328E 01	0.1754	0.0452	1.203E 02	1.930E 00	4.766E 00	1.987E-01
50.0	0.8425	0.5432	5.249E 02	2.110E 01	0.1956	0.0513	1.192E 02	1.948E 00	4.308E 00	1.958E-01
55.0	0.8468	0.5513	4.734E 02	1.921E 01	0.2153	0.0575	1.182E 02	1.967E 00	3.932E 00	1.953E-01
60.0	0.8498	0.5571	4.305E 02	1.759E 01	0.2348	0.0639	1.172E 02	1.986E 00	3.619E 00	1.963E-01
65.0	0.8520	0.5615	3.940E 02	1.618E 01	0.2538	0.0703	1.162E 02	2.007E 00	3.357E 00	1.983E-01
70.0	0.8538	0.5649	3.627E 02	1.496E 01	0.2725	0.0769	1.153E 02	2.028E 00	3.133E 00	2.010E-01
75.0	0.8547	0.5667	3.353E 02	1.386E 01	0.2910	0.0836	1.145E 02	2.051E 00	2.937E 00	2.049E-01
80.0	0.8550	0.5673	3.113E 02	1.287E 01	0.3094	0.0906	1.138E 02	2.076E 00	2.763E 00	2.100E-01
85.0	0.8545	0.5663	2.907E 02	1.201E 01	0.3274	0.0977	1.131E 02	2.103E 00	2.610E 00	2.163E-01
90.0	0.8539	0.5651	2.719E 02	1.122E 01	0.3458	0.1052	1.124E 02	2.131E 00	2.469E 00	2.233E-01
95.0	0.8523	0.5621	2.548E 02	1.047E 01	0.3638	0.1128	1.118E 02	2.161E 00	2.343E 00	2.321E-01
100.0	0.8505	0.5586	2.397E 02	9.814E 00	0.3824	0.1210	1.112E 02	2.193E 00	2.224E 00	2.420E-01
105.0	0.8483	0.5543	2.258E 02	9.198E 00	0.4012	0.1297	1.107E 02	2.230E 00	2.114E 00	2.533E-01
110.0	0.8457	0.5492	2.135E 02	8.643E 00	0.4205	0.1389	1.103E 02	2.271E 00	2.011E 00	2.663E-01
115.0	0.8425	0.5432	2.020E 02	8.120E 00	0.4405	0.1490	1.099E 02	2.316E 00	1.912E 00	2.816E-01
120.0	0.8381	0.5351	1.914E 02	7.619E 00	0.4622	0.1604	1.095E 02	2.369E 00	1.813E 00	3.010E-01
125.0	0.8330	0.5259	1.816E 02	7.145E 00	0.4855	0.1734	1.093E 02	2.433E 00	1.716E 00	3.246E-01
130.0	0.8258	0.5131	1.721E 02	6.666E 00	0.5119	0.1891	1.091E 02	2.512E 00	1.613E 00	3.570E-01
135.0	0.8163	0.4970	1.632E 02	6.194E 00	0.5402	0.2071	1.096E 02	2.619E 00	1.511E 00	3.995E-01
140.0	0.8046	0.4780	1.545E 02	5.722E 00	0.5724	0.2294	1.107E 02	2.766E 00	1.406E 00	4.570E-01
145.0	0.7896	0.4549	1.460E 02	5.243E 00	0.6075	0.2560	1.131E 02	2.970E 00	1.300E 00	5.359E-01
150.0	0.7666	0.4221	1.369E 02	4.699E 00	0.6606	0.3020	1.185E 02	3.379E 00	1.161E 00	6.875E-01
152.6 e f	0.727	0.372	0.127E 03	0.406E 01	0.727	0.372	0.127E 03	0.406E 01	1.000E 00	1.000E 00
130.1 g					0.512	0.189				
76.9	0.855	0.567								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 370					
6.0	0.1010	0.0244	4.362E 03	6.561E 01	0.0029	0.0007	1.337E 02	1.857E 00	3.436E 01	9.017E-01
8.0	0.3096	0.0907	3.317E 03	6.056E 01	0.0120	0.0027	1.330E 02	1.860E 00	2.583E 01	6.987E-01
10.0	0.4301	0.1437	2.673E 03	5.567E 01	0.0208	0.0047	1.324E 02	1.865E 00	2.071E 01	5.820E-01
12.0	0.5157	0.1914	2.243E 03	5.190E 01	0.0298	0.0068	1.319E 02	1.871E 00	1.730E 01	4.992E-01
14.0	0.5750	0.2312	1.932E 03	4.843E 01	0.0387	0.0089	1.312E 02	1.875E 00	1.486E 01	4.421E-01
16.0	0.6159	0.2629	1.697E 03	4.514E 01	0.0473	0.0109	1.307E 02	1.880E 00	1.303E 01	4.031E-01
18.0	0.6464	0.2890	1.516E 03	4.225E 01	0.0557	0.0129	1.302E 02	1.887E 00	1.161E 01	3.744E-01
20.0	0.6720	0.3130	1.362E 03	3.954E 01	0.0642	0.0150	1.297E 02	1.892E 00	1.047E 01	3.505E-01
25.0	0.7175	0.3609	1.089E 03	3.414E 01	0.0852	0.0203	1.284E 02	1.907E 00	8.420E 00	3.088E-01
30.0	0.7473	0.3967	9.062E 02	2.998E 01	0.1060	0.0257	1.273E 02	1.923E 00	7.050E 00	2.827E-01
35.0	0.7679	0.4239	7.725E 02	2.658E 01	0.1265	0.0312	1.262E 02	1.940E 00	6.069E 00	2.657E-01
40.0	0.7842	0.4470	6.745E 02	2.396E 01	0.1472	0.0370	1.251E 02	1.958E 00	5.327E 00	2.530E-01
45.0	0.7965	0.4654	5.960E 02	2.171E 01	0.1677	0.0429	1.241E 02	1.977E 00	4.751E 00	2.444E-01
50.0	0.8059	0.4800	5.334E 02	1.980E 01	0.1879	0.0489	1.230E 02	1.996E 00	4.289E 00	2.390E-01
55.0	0.8127	0.4911	4.816E 02	1.814E 01	0.2077	0.0551	1.201E 02	1.986E 00	3.913E 00	2.364E-01
60.0	0.8178	0.4995	4.380E 02	1.667E 01	0.2274	0.0614	1.210E 02	2.038E 00	3.597E 00	2.358E-01
65.0	0.8211	0.5050	4.008E 02	1.537E 01	0.2467	0.0679	1.201E 02	2.060E 00	3.328E 00	2.375E-01
70.0	0.8228	0.5079	3.687E 02	1.419E 01	0.2659	0.0745	1.192E 02	2.083E 00	3.095E 00	2.414E-01
75.0	0.8234	0.5091	3.407E 02	1.313E 01	0.2845	0.0812	1.185E 02	2.109E 00	2.894E 00	2.468E-01
80.0	0.8234	0.5091	3.162E 02	1.218E 01	0.3032	0.0882	1.178E 02	2.136E 00	2.716E 00	2.534E-01
85.0	0.8233	0.5088	2.946E 02	1.135E 01	0.3218	0.0954	1.171E 02	2.164E 00	2.558E 00	2.606E-01
90.0	0.8227	0.5078	2.755E 02	1.060E 01	0.3406	0.1030	1.164E 02	2.195E 00	2.416E 00	2.689E-01
95.0	0.8217	0.5061	2.583E 02	9.917E 00	0.3592	0.1108	1.159E 02	2.229E 00	2.288E 00	2.782E-01
100.0	0.8203	0.5038	2.433E 02	9.312E 00	0.3784	0.1192	1.153E 02	2.265E 00	2.168E 00	2.890E-01
105.0	0.8184	0.5005	2.290E 02	8.731E 00	0.3979	0.1281	1.149E 02	2.306E 00	2.057E 00	3.016E-01
110.0	0.8158	0.4961	2.164E 02	8.203E 00	0.4179	0.1376	1.146E 02	2.352E 00	1.952E 00	3.164E-01
115.0	0.8121	0.4901	2.046E 02	7.696E 00	0.4388	0.1481	1.144E 02	2.407E 00	1.851E 00	3.348E-01
120.0	0.8084	0.4840	1.938E 02	7.233E 00	0.4615	0.1601	1.144E 02	2.472E 00	1.752E 00	3.558E-01
125.0	0.8023	0.4743	1.836E 02	6.765E 00	0.4849	0.1731	1.148E 02	2.553E 00	1.655E 00	3.838E-01
130.0	0.7941	0.4617	1.738E 02	6.297E 00	0.5116	0.1889	1.154E 02	2.655E 00	1.552E 00	4.215E-01
135.0	0.7829	0.4450	1.643E 02	5.820E 00	0.5430	0.2090	1.170E 02	2.808E 00	1.442E 00	4.751E-01
140.0	0.7665	0.4219	1.548E 02	5.312E 00	0.5781	0.2335	1.206E 02	3.036E 00	1.326E 00	5.534E-01
145.0	0.7399	0.3875	1.447E 02	4.725E 00	0.6339	0.2780	1.263E 02	3.452E 00	1.167E 00	7.104E-01
146.6[e]	0.696	0.337	0.135E 03	0.408E 01	0.696	0.337	0.135E 03	0.408E 01	1.000E 00	1.000E 00
122.6[f]					0.472	0.166				
78.2[g]	0.816	0.497								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 380					
8.0	0.1411	0.0352	3.286E 03	5.115E 01	0.0056	0.0012	1.367E 02	1.903E 00	2.536E 01	8.637E-01
10.0	0.2974	0.0860	2.660E 03	4.795E 01	0.0146	0.0033	1.361E 02	1.908E 00	2.036E 01	7.130E-01
12.0	0.3986	0.1284	2.236E 03	4.491E 01	0.0234	0.0053	1.355E 02	1.913E 00	1.702E 01	6.158E-01
14.0	0.4705	0.1650	1.929E 03	4.215E 01	0.0322	0.0073	1.350E 02	1.919E 00	1.463E 01	5.471E-01
16.0	0.5271	0.1986	1.696E 03	3.984E 01	0.0411	0.0094	1.344E 02	1.925E 00	1.283E 01	4.931E-01
18.0	0.5709	0.2283	1.512E 03	3.770E 01	0.0499	0.0116	1.339E 02	1.931E 00	1.143E 01	4.517E-01
20.0	0.6022	0.2518	1.363E 03	3.554E 01	0.0584	0.0136	1.334E 02	1.937E 00	1.032E 01	4.225E-01
25.0	0.6590	0.3005	1.094E 03	3.110E 01	0.0794	0.0188	1.323E 02	1.954E 00	8.304E 00	3.704E-01
30.0	0.6939	0.3351	9.120E 02	2.746E 01	0.0997	0.0240	1.312E 02	1.971E 00	6.961E 00	3.400E-01
35.0	0.7199	0.3637	7.813E 02	2.460E 01	0.1200	0.0294	1.302E 02	1.990E 00	5.997E 00	3.183E-01
40.0	0.7409	0.3887	6.814E 02	2.228E 01	0.1406	0.0351	1.291E 02	2.009E 00	5.269E 00	3.015E-01
45.0	0.7555	0.4073	6.028E 02	2.026E 01	0.1608	0.0409	1.281E 02	2.030E 00	4.697E 00	2.913E-01
50.0	0.7675	0.4232	5.395E 02	1.855E 01	0.1812	0.0469	1.271E 02	2.050E 00	4.236E 00	2.840E-01
55.0	0.7753	0.4342	4.872E 02	1.701E 01	0.2008	0.0529	1.262E 02	2.072E 00	3.862E 00	2.811E-01
60.0	0.7817	0.4433	4.430E 02	1.566E 01	0.2208	0.0593	1.252E 02	2.095E 00	3.540E 00	2.802E-01
65.0	0.7855	0.4488	4.054E 02	1.444E 01	0.2402	0.0657	1.224E 02	2.087E 00	3.270E 00	2.823E-01
70.0	0.7876	0.4520	3.727E 02	1.333E 01	0.2593	0.0722	1.235E 02	2.144E 00	3.037E 00	2.867E-01
75.0	0.7888	0.4536	3.444E 02	1.234E 01	0.2783	0.0790	1.228E 02	2.172E 00	2.835E 00	2.927E-01
80.0	0.7891	0.4541	3.195E 02	1.146E 01	0.2972	0.0859	1.222E 02	2.202E 00	2.655E 00	3.001E-01
85.0	0.7890	0.4540	2.974E 02	1.067E 01	0.3161	0.0932	1.216E 02	2.234E 00	2.496E 00	3.085E-01
90.0	0.7884	0.4530	2.780E 02	9.957E 00	0.3354	0.1009	1.211E 02	2.271E 00	2.350E 00	3.184E-01
95.0	0.7867	0.4506	2.604E 02	9.296E 00	0.3547	0.1089	1.208E 02	2.313E 00	2.218E 00	3.305E-01
100.0	0.7851	0.4482	2.444E 02	8.698E 00	0.3743	0.1174	1.205E 02	2.355E 00	2.097E 00	3.435E-01
105.0	0.7835	0.4458	2.301E 02	8.161E 00	0.3947	0.1266	1.203E 02	2.405E 00	1.985E 00	3.577E-01
110.0	0.7803	0.4413	2.169E 02	7.645E 00	0.4151	0.1363	1.204E 02	2.464E 00	1.880E 00	3.755E-01
115.0	0.7762	0.4354	2.049E 02	7.164E 00	0.4365	0.1469	1.209E 02	2.537E 00	1.778E 00	3.971E-01
120.0	0.7707	0.4278	1.936E 02	6.698E 00	0.4614	0.1600	1.230E 02	2.658E 00	1.670E 00	4.257E-01
125.0	0.7621	0.4160	1.828E 02	6.221E 00	0.4899	0.1760	1.229E 02	2.751E 00	1.555E 00	4.664E-01
130.0	0.7494	0.3994	1.724E 02	5.727E 00	0.5230	0.1960	1.255E 02	2.933E 00	1.433E 00	5.253E-01
135.0	0.7292	0.3745	1.617E 02	5.178E 00	0.5663	0.2250	1.297E 02	3.213E 00	1.288E 00	6.244E-01
139.6[e]	0.659	0.301	0.144E 03	0.408E 01	0.659	0.301	0.144E 03	0.408E 01	1.000E 00	1.000E 00
114.9[f]					0.435	0.146				
78.9[g]	0.789	0.454								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N–PENTANE
				TEMPERATURE, DEG. K 390						
10.0	0.1401	0.0350	2.610E 03	4.059E 01	0.0071	0.0016	1.402E 02	1.954E 00	1.986E 01	8.660E-01
12.0	0.2653	0.0743	2.197E 03	3.836E 01	0.0160	0.0036	1.397E 02	1.960E 00	1.661E 01	7.467E-01
14.0	0.3550	0.1090	1.900E 03	3.638E 01	0.0249	0.0056	1.391E 02	1.966E 00	1.428E 01	6.614E-01
16.0	0.4144	0.1360	1.670E 03	3.416E 01	0.0331	0.0075	1.388E 02	1.974E 00	1.254E 01	6.056E-01
18.0	0.4615	0.1601	1.491E 03	3.223E 01	0.0413	0.0095	1.383E 02	1.980E 00	1.118E 01	5.617E-01
20.0	0.5036	0.1840	1.347E 03	3.068E 01	0.0499	0.0115	1.378E 02	1.987E 00	1.009E 01	5.225E-01
25.0	0.5810	0.2357	1.086E 03	2.746E 01	0.0714	0.0168	1.366E 02	2.005E 00	8.136E 00	4.512E-01
30.0	0.6277	0.2727	9.088E 02	2.461E 01	0.0920	0.0220	1.356E 02	2.024E 00	6.820E 00	4.100E-01
35.0	0.6615	0.3029	7.798E 02	2.226E 01	0.1126	0.0274	1.345E 02	2.043E 00	5.877E 00	3.814E-01
40.0	0.6865	0.3275	6.825E 02	2.029E 01	0.1329	0.0329	1.335E 02	2.064E 00	5.167E 00	3.615E-01
45.0	0.7065	0.3486	6.046E 02	1.860E 01	0.1533	0.0387	1.325E 02	2.086E 00	4.608E 00	3.467E-01
50.0	0.7224	0.3665	5.415E 02	1.713E 01	0.1737	0.0447	1.316E 02	2.108E 00	4.159E 00	3.360E-01
55.0	0.7339	0.3801	4.892E 02	1.579E 01	0.1940	0.0508	1.307E 02	2.133E 00	3.783E 00	3.302E-01
60.0	0.7414	0.3893	4.450E 02	1.457E 01	0.2139	0.0570	1.298E 02	2.158E 00	3.467E 00	3.290E-01
65.0	0.7453	0.3942	4.071E 02	1.342E 01	0.2332	0.0634	1.291E 02	2.186E 00	3.195E 00	3.321E-01
70.0	0.7476	0.3971	3.744E 02	1.239E 01	0.2526	0.0699	1.284E 02	2.215E 00	2.960E 00	3.377E-01
75.0	0.7488	0.3986	3.458E 02	1.147E 01	0.2719	0.0767	1.261E 02	2.216E 00	2.753E 00	3.451E-01
80.0	0.7492	0.3991	3.205E 02	1.064E 01	0.2915	0.0838	1.272E 02	2.280E 00	2.570E 00	3.540E-01
85.0	0.7491	0.3990	2.981E 02	9.896E 00	0.3111	0.0912	1.267E 02	2.317E 00	2.408E 00	3.642E-01
90.0	0.7486	0.3983	2.780E 02	9.221E 00	0.3311	0.0991	1.265E 02	2.360E 00	2.261E 00	3.759E-01
95.0	0.7474	0.3969	2.599E 02	8.602E 00	0.3517	0.1076	1.264E 02	2.411E 00	2.125E 00	3.896E-01
100.0	0.7451	0.3939	2.435E 02	8.024E 00	0.3725	0.1166	1.264E 02	2.466E 00	2.000E 00	4.062E-01
105.0	0.7415	0.3894	2.283E 02	7.474E 00	0.3936	0.1261	1.268E 02	2.533E 00	1.884E 00	4.263E-01
110.0	0.7368	0.3837	2.144E 02	6.959E 00	0.4172	0.1373	1.274E 02	2.613E 00	1.766E 00	4.515E-01
115.0	0.7294	0.3747	2.013E 02	6.445E 00	0.4440	0.1508	1.286E 02	2.723E 00	1.643E 00	4.868E-01
120.0	0.7185	0.3620	1.886E 02	5.922E 00	0.4756	0.1678	1.311E 02	2.882E 00	1.511E 00	5.368E-01
125.0	0.7013	0.3430	1.759E 02	5.364E 00	0.5198	0.1940	1.356E 02	3.154E 00	1.349E 00	6.220E-01
130.0[e]	0.6648	0.3060	1.609E 02	4.616E 00	0.5868	0.2400	1.456E 02	3.713E 00	1.133E 00	8.113E-01
131.3[f]	0.621	0.267	0.152E 03	0.408E 01	0.621	0.267	0.152E 03	0.408E 01	1.000E 00	1.000E 00
106.7[g]					0.400	0.129				
78.9[g]	0.749	0.399								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. K 400					
12.0	0.1444	0.0362	2.151E 03	3.359E 01	0.0090	0.0020	1.440E 02	2.010E 00	1.606E 01	8.633E-01
14.0	0.2443	0.0671	1.868E 03	3.197E 01	0.0177	0.0040	1.437E 02	2.020E 00	1.383E 01	7.693E-01
16.0	0.3209	0.0951	1.617E 03	2.987E 01	0.0264	0.0060	1.432E 02	2.027E 00	1.214E 01	6.975E-01
18.0	0.3792	0.1196	1.478E 03	2.904E 01	0.0350	0.0080	1.428E 02	2.035E 00	1.083E 01	6.433E-01
20.0	0.4266	0.1420	1.337E 03	2.774E 01	0.0436	0.0100	1.424E 02	2.043E 00	9.785E 00	5.995E-01
25.0	0.5054	0.1852	1.078E 03	2.461E 01	0.0640	0.0150	1.413E 02	2.061E 00	7.894E 00	5.284E-01
30.0	0.5590	0.2199	9.018E 02	2.211E 01	0.0844	0.0201	1.404E 02	2.082E 00	6.626E 00	4.817E-01
35.0	0.5992	0.2495	7.752E 02	2.012E 01	0.1049	0.0254	1.394E 02	2.103E 00	5.714E 00	4.477E-01
40.0	0.6289	0.2736	6.786E 02	1.841E 01	0.1252	0.0308	1.384E 02	2.125E 00	5.024E 00	4.242E-01
45.0	0.6524	0.2944	6.013E 02	1.692E 01	0.1457	0.0365	1.375E 02	2.149E 00	4.478E 00	4.069E-01
50.0	0.6689	0.3100	5.387E 02	1.556E 01	0.1661	0.0424	1.366E 02	2.174E 00	4.028E 00	3.970E-01
55.0	0.6817	0.3226	4.869E 02	1.436E 01	0.1864	0.0485	1.358E 02	2.202E 00	3.656E 00	3.913E-01
60.0	0.6908	0.3319	4.430E 02	1.327E 01	0.2068	0.0548	1.351E 02	2.231E 00	3.341E 00	3.898E-01
65.0	0.6970	0.3384	4.051E 02	1.226E 01	0.2270	0.0613	1.344E 02	2.262E 00	3.070E 00	3.920E-01
70.0	0.7004	0.3420	3.725E 02	1.134E 01	0.2472	0.0680	1.338E 02	2.296E 00	2.834E 00	3.980E-01
75.0	0.7017	0.3435	3.441E 02	1.050E 01	0.2673	0.0750	1.334E 02	2.334E 00	2.625E 00	4.071E-01
80.0	0.7022	0.3440	3.185E 02	9.725E 00	0.2877	0.0824	1.330E 02	2.375E 00	2.441E 00	4.180E-01
85.0	0.7016	0.3433	2.959E 02	9.024E 00	0.3082	0.0901	1.329E 02	2.423E 00	2.276E 00	4.314E-01
90.0	0.6993	0.3409	2.749E 02	8.352E 00	0.3291	0.0984	1.331E 02	2.478E 00	2.125E 00	4.482E-01
95.0	0.6942	0.3354	2.557E 02	7.702E 00	0.3497	0.1068	1.337E 02	2.545E 00	1.985E 00	4.703E-01
100.0	0.6871	0.3281	2.380E 02	7.085E 00	0.3730	0.1168	1.343E 02	2.622E 00	1.842E 00	4.990E-01
105.0	0.6795	0.3204	2.213E 02	6.502E 00	0.3990	0.1286	1.354E 02	2.720E 00	1.703E 00	5.333E-01
110.0	0.6666	0.3077	2.047E 02	5.889E 00	0.4283	0.1428	1.372E 02	2.852E 00	1.556E 00	5.833E-01
115.0	0.6492	0.2915	1.882E 02	5.267E 00	0.4678	0.1635	1.410E 02	3.072E 00	1.388E 00	6.592E-01
120.0	0.6155	0.2625	1.697E 02	4.512E 00	0.5246	0.1970	1.473E 02	3.449E 00	1.173E 00	8.087E-01
121.5[e]	0.576	0.232	0.163E 03	0.408E 01	0.576	0.232	0.163E 03	0.408E 01	1.000E 00	1.000E 00
98.1[f]					0.362	0.112				
78.0[g]	0.702	0.344								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N–PENTANE
					TEMPERATURE, DEG. K 410					
14.0	0.0875	0.0209	1.800E 03	2.677E 01	0.0067	0.0015	1.493E 02	2.080E 00	1.315E 01	9.186E-01
16.0	0.1759	0.0453	1.592E 03	2.556E 01	0.0152	0.0034	1.488E 02	2.087E 00	1.156E 01	8.369E-01
18.0	0.2456	0.0675	1.428E 03	2.446E 01	0.0238	0.0054	1.485E 02	2.096E 00	1.032E 01	7.728E-01
20.0	0.3029	0.0881	1.294E 03	2.347E 01	0.0325	0.0074	1.480E 02	2.105E 00	9.330E 00	7.205E-01
25.0	0.4042	0.1311	1.050E 03	2.122E 01	0.0536	0.0124	1.471E 02	2.127E 00	7.534E 00	6.296E-01
30.0	0.4722	0.1659	8.820E 02	1.932E 01	0.0746	0.0176	1.462E 02	2.151E 00	6.327E 00	5.703E-01
35.0	0.5214	0.1950	7.607E 02	1.773E 01	0.0956	0.0230	1.453E 02	2.176E 00	5.456E 00	5.291E-01
40.0	0.5595	0.2202	6.665E 02	1.635E 01	0.1168	0.0286	1.444E 02	2.202E 00	4.791E 00	4.987E-01
45.0	0.5891	0.2417	5.921E 02	1.514E 01	0.1379	0.0344	1.436E 02	2.229E 00	4.271E 00	4.767E-01
50.0	0.6110	0.2588	5.312E 02	1.403E 01	0.1591	0.0404	1.428E 02	2.258E 00	3.840E 00	4.626E-01
55.0	0.6267	0.2718	4.803E 02	1.299E 01	0.1801	0.0466	1.420E 02	2.289E 00	3.480E 00	4.553E-01
60.0	0.6378	0.2814	4.370E 02	1.202E 01	0.2008	0.0529	1.413E 02	2.321E 00	3.176E 00	4.532E-01
65.0	0.6453	0.2880	3.951E 02	1.099E 01	0.2217	0.0596	1.408E 02	2.359E 00	2.911E 00	4.557E-01
70.0	0.6493	0.2916	3.669E 02	1.027E 01	0.2425	0.0665	1.404E 02	2.398E 00	2.677E 00	4.630E-01
75.0	0.6509	0.2930	3.380E 02	9.486E 00	0.2634	0.0737	1.403E 02	2.445E 00	2.471E 00	4.740E-01
80.0	0.6497	0.2920	3.120E 02	8.741E 00	0.2850	0.0814	1.403E 02	2.498E 00	2.280E 00	4.899E-01
85.0	0.6465	0.2891	2.885E 02	8.041E 00	0.3070	0.0897	1.407E 02	2.561E 00	2.106E 00	5.101E-01
90.0	0.6394	0.2827	2.667E 02	7.351E 00	0.3280	0.0979	1.418E 02	2.639E 00	1.949E 00	5.367E-01
95.0	0.6292	0.2740	2.463E 02	6.683E 00	0.3506	0.1072	1.439E 02	2.741E 00	1.795E 00	5.709E-01
100.0	0.6149	0.2620	2.274E 02	6.038E 00	0.3801	0.1200	1.460E 02	2.873E 00	1.618E 00	6.213E-01
105.0	0.5927	0.2445	2.073E 02	5.329E 00	0.4217	0.1395	1.508E 02	3.110E 00	1.406E 00	7.042E-01
110.0	0.5520	0.2150	1.835E 02	4.455E 00	0.4925	0.1775	1.638E 02	3.680E 00	1.121E 00	8.829E-01
110.6[e]	0.526	0.198	0.174E 03	0.408E 01	0.526	0.198	0.174E 03	0.408E 01	1.000E 00	1.000E 00
89.7[f]					0.326	0.097				
76.4[g]	0.651	0.293								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N-PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
				TEMPERATURE, DEG. K 420						
16.0	0.0528	0.0123	1.505E 03	2.176E 01	0.0050	0.0011	1.558E 02	2.168E 00	1.067E 01	9.519E-01
18.0	0.1256	0.0309	1.366E 03	2.097E 01	0.0132	0.0030	1.555E 02	2.177E 00	9.533E 00	8.861E-01
20.0	0.1913	0.0500	1.246E 03	2.029E 01	0.0222	0.0050	1.549E 02	2.185E 00	8.630E 00	8.270E-01
25.0	0.3079	0.0900	1.015E 03	1.850E 01	0.0440	0.0101	1.539E 02	2.208E 00	6.994E 00	7.240E-01
30.0	0.3892	0.1241	8.567E 02	1.703E 01	0.0660	0.0155	1.528E 02	2.232E 00	5.895E 00	6.540E-01
35.0	0.4457	0.1517	7.377E 02	1.565E 01	0.0874	0.0209	1.519E 02	2.259E 00	5.098E 00	6.074E-01
40.0	0.4901	0.1761	6.478E 02	1.451E 01	0.1093	0.0266	1.511E 02	2.289E 00	4.484E 00	5.725E-01
45.0	0.5199	0.1940	5.756E 02	1.339E 01	0.1302	0.0322	1.505E 02	2.321E 00	3.993E 00	5.520E-01
50.0	0.5457	0.2108	5.174E 02	1.246E 01	0.1524	0.0384	1.500E 02	2.359E 00	3.580E 00	5.360E-01
55.0	0.5630	0.2226	4.671E 02	1.151E 01	0.1740	0.0447	1.497E 02	2.399E 00	3.236E 00	5.291E-01
60.0	0.5742	0.2307	4.238E 02	1.061E 01	0.1956	0.0513	1.496E 02	2.445E 00	2.935E 00	5.293E-01
65.0	0.5812	0.2358	3.858E 02	9.757E 00	0.2177	0.0583	1.496E 02	2.495E 00	2.669E 00	5.354E-01
70.0	0.5844	0.2382	3.525E 02	8.956E 00	0.2394	0.0654	1.498E 02	2.551E 00	2.441E 00	5.464E-01
75.0	0.5853	0.2389	3.233E 02	8.224E 00	0.2626	0.0734	1.486E 02	2.588E 00	2.229E 00	5.624E-01
80.0	0.5819	0.2363	2.954E 02	7.478E 00	0.2852	0.0815	1.517E 02	2.702E 00	2.040E 00	5.850E-01
85.0	0.5742	0.2307	2.721E 02	6.813E 00	0.3102	0.0909	1.541E 02	2.816E 00	1.851E 00	6.173E-01
90.0	0.5607	0.2211	2.488E 02	6.115E 00	0.3384	0.1021	1.586E 02	2.983E 00	1.657E 00	6.639E-01
95.0	0.5519	0.2150	2.288E 02	5.555E 00	0.3768	0.1185	1.660E 02	3.255E 00	1.465E 00	7.190E-01
99.5[e]	0.472	0.166	0.186E 03	0.408E 01	0.472	0.166	0.186E 03	0.408E 01	1.000E 00	1.000E 00
81.0[f]					0.289	0.083				
73.7[g]	0.585	0.239								
				TEMPERATURE, DEG. K 430						
18.0	0.0082	0.0018	1.299E 03	1.812E 01	0.0010	0.0002	1.632E 02	2.263E 00	8.506E 00	9.928E-01
20.0	0.0762	0.0180	1.180E 03	1.738E 01	0.0098	0.0022	1.628E 02	2.274E 00	7.750E 00	9.330E-01
25.0	0.2014	0.0531	9.627E 02	1.582E 01	0.0317	0.0072	1.620E 02	2.302E 00	6.344E 00	8.248E-01
30.0	0.2928	0.0843	8.126E 02	1.458E 01	0.0545	0.0127	1.610E 02	2.330E 00	5.368E 00	7.480E-01
35.0	0.3615	0.1118	7.037E 02	1.357E 01	0.0776	0.0184	1.602E 02	2.362E 00	4.656E 00	6.923E-01
40.0	0.4102	0.1339	6.186E 02	1.259E 01	0.1002	0.0242	1.596E 02	2.399E 00	4.095E 00	6.555E-01
45.0	0.4417	0.1496	5.519E 02	1.165E 01	0.1215	0.0298	1.595E 02	2.441E 00	3.636E 00	6.356E-01
50.0	0.4669	0.1630	4.937E 02	1.074E 01	0.1437	0.0360	1.595E 02	2.489E 00	3.248E 00	6.226E-01
55.0	0.4845	0.1728	4.453E 02	9.902E 00	0.1665	0.0425	1.599E 02	2.545E 00	2.909E 00	6.185E-01
60.0	0.4957	0.1794	4.012E 02	9.049E 00	0.1894	0.0494	1.604E 02	2.608E 00	2.617E 00	6.222E-01
65.0	0.5018	0.1830	3.621E 02	8.230E 00	0.2126	0.0566	1.617E 02	2.686E 00	2.360E 00	6.328E-01
70.0	0.5035	0.1840	3.273E 02	7.456E 00	0.2369	0.0646	1.638E 02	2.782E 00	2.126E 00	6.506E-01
75.0	0.5016	0.1829	2.963E 02	6.732E 00	0.2627	0.0734	1.673E 02	2.914E 00	1.909E 00	6.760E-01
80.0	0.4905	0.1763	2.669E 02	5.981E 00	0.2924	0.0842	1.726E 02	3.097E 00	1.677E 00	7.200E-01
85.0[e]	0.4674	0.1632	2.376E 02	5.174E 00	0.3381	0.1020	1.817E 02	3.417E 00	1.382E 00	8.047E-01
87.9[f]	0.406	0.132	0.201E 03	0.408E 01	0.406	0.132	0.201E 03	0.408E 01	1.000E 00	1.000E 00
72.3					0.250	0.069				
69.5[g]	0.503	0.184								

See footnotes at the end of this table.

TABLE 3.1. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE-N-PENTANE SYSTEM – CONTINUED

PRESSURE[a] ATM	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
TEMPERATURE, DEG. K 440										
25.0	0.0948	0.0227	8.984E 02	1.344E 01	0.0177	0.0040	1.712E 02	2.405E 00	5.340E 00	9.216E-01
30.0	0.1881	0.0490	7.582E 02	1.231E 01	0.0411	0.0094	1.706E 02	2.443E 00	4.577E 00	8.467E-01
35.0	0.2590	0.0721	6.560E 02	1.139E 01	0.0648	0.0152	1.704E 02	2.487E 00	4.000E 00	7.923E-01
40.0	0.3172	0.0936	5.776E 02	1.063E 01	0.0896	0.0214	1.703E 02	2.536E 00	3.539E 00	7.500E-01
45.0	0.3562	0.1096	5.135E 02	9.844E 00	0.1127	0.0275	1.708E 02	2.595E 00	3.160E 00	7.256E-01
50.0	0.3855	0.1224	4.594E 02	9.092E 00	0.1364	0.0339	1.718E 02	2.663E 00	2.826E 00	7.116E-01
55.0	0.4019	0.1300	4.115E 02	8.296E 00	0.1595	0.0405	1.734E 02	2.744E 00	2.520E 00	7.116E-01
60.0	0.4082	0.1330	3.672E 02	7.455E 00	0.1848	0.0480	1.754E 02	2.839E 00	2.208E 00	7.260E-01
65.0	0.4080	0.1329	3.254E 02	6.606E 00	0.2113	0.0562	1.803E 02	2.990E 00	1.931E 00	7.506E-01
70.0	0.4011	0.1296	2.870E 02	5.782E 00	0.2450	0.0673	1.878E 02	3.215E 00	1.637E 00	7.933E-01
75.0	0.3561	0.1095	2.420E 02	4.638E 00	0.3054	0.0891	1.980E 02	3.600E 00	1.166E 00	9.271E-01
75.3[e]	0.331	0.099	0.219E 03	0.408E 01	0.331	0.099	0.219E 03	0.408E 01	1.000E 00	1.000E 00
63.4[f]					0.201	0.053				
63.8[g]	0.408	0.133								
TEMPERATURE, DEG. K 450										
25.0	0.009	0.002	0.832E 03	0.116E 02	0.002	0.000	0.182E 03	0.252E 01	4.17E 00	9.93E-01
30.0	0.100	0.024	0.698E 03	0.105E 02	0.027	0.006	0.182E 03	0.258E 01	3.65E 00	9.26E-01
35.0	0.168	0.043	0.598E 03	0.953E 01	0.052	0.012	0.182E 03	0.263E 01	3.21E 00	8.78E-01
40.0	0.223	0.060	0.527E 03	0.884E 01	0.078	0.019	0.183E 03	0.270E 01	2.84E 00	8.43E-01
45.0	0.260	0.072	0.461E 03	0.801E 01	0.103	0.025	0.185E 03	0.279E 01	2.52E 00	8.25E-01
50.0	0.280	0.080	0.406E 03	0.720E 01	0.126	0.031	0.188E 03	0.289E 01	2.22E 00	8.23E-01
55.0	0.291	0.084	0.356E 03	0.639E 01	0.154	0.039	0.192E 03	0.302E 01	1.90E 00	8.37E-01
60.0	0.280	0.079	0.307E 03	0.543E 01	0.185	0.048	0.205E 03	0.333E 01	1.51E 00	8.84E-01
62.5[e]	0.244	0.067	0.239E 03	0.408E 01	0.244	0.067	0.239E 03	0.408E 01	1.00E 00	1.00E 00
53.9[f]					0.147	0.037				
55.9[g]	0.292	0.084								
TEMPERATURE, DEG. K 460										
30.0	0.019	0.004	0.614E 03	0.864E 01	0.007	0.001	0.196E 03	0.273E 01	2.78E 00	9.88E-01
35.0	0.083	0.020	0.537E 03	0.795E 01	0.034	0.008	0.197E 03	0.281E 01	2.42E 00	9.49E-01
40.0	0.131	0.032	0.466E 03	0.720E 01	0.063	0.015	0.199E 03	0.290E 01	2.09E 00	9.27E-01
45.0	0.161	0.041	0.409E 03	0.649E 01	0.092	0.022	0.205E 03	0.306E 01	1.75E 00	9.24E-01
48.6[e]	0.137	0.034	0.263E 03	0.408E 01	0.137	0.034	0.263E 03	0.408E 01	1.00E 00	1.00E 00
46.0[f]					0.165	0.042				
44.5[g]	0.084	0.020								

[a] (Atm) (101325.0) N/m^2

[b] Molal equilibrium ratio, $K_k \; y_k / x_k$

[c] Volume expressed in liters/kg-mol

[d] Volume expressed on liters/kg

[e] Estimated critical state

[f] Estimated maxcondenbar

[g] Estimated maxcondentherm

TABLE 3.2. *Agreement of interpolated and experimental data for the methane-n-pentane system*

Source	Number of points	Average [a]	Deviation fraction [b]	Standard [c]
Composition [d]				
Taylor [36]	14	0.0021	0.0042	0.0116
Dourson [37]	4	.0078	.0198	.0164
Sage [38]	32	.0007	.0035	.0037
Pressure [e]				
Sage [38]	34	−0.05	0.0054	0.33
Sage [35]	9	4.8	.0395	5.5

[a] Average deviation defined by $\left[\sum_{1}^{N}(G_{k\,\mathrm{exp}}-G_{k\,\mathrm{sm}})\right]/N$.

[b] Fractional deviation defined by $\left\{\sum_{1}^{N}\left[(G_{k\,\mathrm{exp}}-G_{k\,\mathrm{sm}})/G_{k\,\mathrm{exp}}\right]\right\}/N$.

[c] Standard deviation defined by $\left\{\left[\sum_{1}^{N}(G_{k\,\mathrm{exp}}-G_{k\,\mathrm{sm}})^{2}\right]/(N-1)\right\}^{1/2}$ where G = either composition or pressure.

[d] Composition in weight fraction methane.
[e] Pressure in atm.

TABLE 3.3. *Unique states for the methane-n-pentane system*

Methane		Critical				Maxcondenbar		Maxcondentherm	
Mole fraction	Weight fraction	Temperature	Pressure [a]	Volume		Temperature	Pressure [a]	Temperature	Pressure [a]
				Molal [b]	Specific [c]				
		K	*atm*			*K*	*atm*	*K*	*atm*
0.0	0.0	[d] 469.49	33.16	294.6	4.08	469.49	33.16	469.49	33.16
.333	.1	439.9	75.9	218	4.08	408.4	91.5	446.6	58.6
.529	.2	409.7	111.3	173	4.08	355.9	133.5	427.0	70.9
.658	.3	380.6	139.0	144	4.08	328.4	152.4	408.6	76.7
.750	.4	351.4	156.4	122	4.04	310.8	162.4	390.0	78.9
.818	.5	311.7	166.5	99	3.78	[e] 294.7	167.5	371.5	78.4
.871	.6	[e] 275.0	169.2	.....	.....	275.3	169.2	353.3	75.8
.913	.7	253.0	167.0	.....	.....	253.0	167.0	333.8	71.2
.947	.8	232.3	155.9	.....	.....	232.3	155.9	[e] 309.7	64.4
.976	.9	211.2	129.4	.....	.....	211.2	129.4	279.3	55.7
1.0	1.0	[d] 190.63	45.57	99.3	6.18	190.6	45.5	190.6	45.5
.1	.024	462.8	44.2	272	4.08	457.9	46.1	463.8	41.4
.2	.053	454.2	57.0	249	4.08	439.9	63.1	456.7	49.2
.3	.087	443.8	70.7	226	4.08	417.0	83.5	449.4	56.4
.4	.129	430.9	86.7	203	4.08	390.3	106.4	440.7	63.2
.5	.182	414.8	105.1	180	4.08	362.9	128.2	430.3	69.3
.6	.250	394.7	126.6	157	4.08	339.7	144.9	417.8	74.4
.7	.342	368.6	147.5	134	4.08	320.7	157.1	400.7	78.0
.8	.471	327.5	164.0	106	3.90	[e] 299.5	166.6	376.9	78.7
.9	.667	260.2	168.4	.....	.....	260.2	168.4	340.2	73.0
Estimated uncertainty [f]		1.0	1.0	3.0		2.0	4.0	2.0	3.0

[a] (Atm) $(1.013250\times10^{5})=\mathrm{N/m^{2}}$.
[b] Volume expressed in liters/kg-mol.
[c] Volume expressed in liters/kg.
[d] API 44 [16].
[e] Values at this and lower temperatures extrapolated.
[f] Estimated uncertainty expressed in percent.

TABLE 3.4. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N–PENTANE
				TEMPERATURE, DEG. F 40						
20.	0.627	0.272	0.264E 03	0.714E 01	0.005	0.001	0.179E 01	0.250E-01	1.16E 02	3.75E-01
40.	0.815	0.495	0.132E 03	0.499E 01	0.014	0.003	0.178E 01	0.250E-01	5.83E 01	1.88E-01
60.	0.878	0.615	0.878E 02	0.383E 01	0.022	0.005	0.178E 01	0.250E-01	3.90E 01	1.25E-01
80.	0.903	0.674	0.656E 02	0.305E 01	0.031	0.007	0.177E 01	0.251E-01	2.94E 01	1.00E-01
100.	0.923	0.727	0.523E 02	0.257E 01	0.039	0.009	0.176E 01	0.251E-01	2.36E 01	8.00E-02
120.	0.936	0.765	0.435E 02	0.221E 01	0.047	0.011	0.175E 01	0.252E-01	1.97E 01	6.71E-02
140.	0.943	0.787	0.371E 02	0.193E 01	0.055	0.013	0.174E 01	0.253E-01	1.70E 01	6.00E-02
160.	0.949	0.806	0.324E 02	0.171E 01	0.063	0.015	0.174E 01	0.253E-01	1.49E 01	5.44E-02
180.	0.954	0.820	0.287E 02	0.154E 01	0.071	0.017	0.173E 01	0.254E-01	1.33E 01	5.00E-02
200.	0.957	0.833	0.257E 02	0.140E 01	0.079	0.019	0.172E 01	0.254E-01	1.20E 01	4.65E-02
400.	0.974	0.891	0.124E 02	0.710E 00	0.155	0.039	0.165E 01	0.260E-01	6.28E 00	3.13E-02
600.	0.977	0.903	0.801E 01	0.461E-00	0.224	0.060	0.158E 01	0.266E-01	4.35E 00	3.00E-02
800.	0.977	0.904	0.579E 01	0.334E-00	0.288	0.083	0.153E 01	0.273E-01	3.39E 00	3.24E-02
1000.	0.977	0.904	0.447E 01	0.258E-00	0.348	0.106	0.148E 01	0.280E-01	2.80E 00	3.53E-02
1200.	0.977	0.903	0.360E 01	0.207E-00	0.407	0.132	0.142E 01	0.289E-01	2.40E 00	3.92E-02
1400.	0.975	0.897	0.297E 01	0.170E-00	0.462	0.160	0.138E 01	0.298E-01	2.11E 00	4.61E-02
1600.	0.972	0.886	0.250E 01	0.142E-00	0.515	0.191	0.133E 01	0.308E-01	1.89E 00	5.75E-02
1800.	0.965	0.861	0.214E 01	0.119E-00	0.567	0.225	0.130E 01	0.321E-01	1.70E 00	8.00E-02
2000.	0.955	0.824	0.184E 01	0.988E-01	0.622	0.267	0.126E 01	0.339E-01	1.54E 00	1.19E-01
2200.	0.938	0.772	0.158E 01	0.809E-01	0.686	0.327	0.124E 01	0.369E-01	1.37E 00	1.97E-01
2400.	0.907	0.683	0.133E 01	0.623E-01	0.767	0.423	0.126E 01	0.433E-01	1.18E 00	4.02E-01
2485.[e]	0.866	0.590			0.866	0.590			1.00E 00	1.00E 00
2485.[f]					0.864	0.585				
816.[g]	0.977	0.903								

See footnotes at the end of this table.

TABLE 3.4. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
				TEMPERATURE, DEG. F 50						
20.	0.577	0.233	0.268E 03	0.675E 01	0.005	0.001	0.181E 01	0.252E-01	1.20E 02	4.25E-01
40.	0.790	0.456	0.134E 03	0.483E 01	0.013	0.003	0.180E 01	0.252E-01	6.03E 01	2.12E-01
60.	0.861	0.580	0.894E 02	0.375E 01	0.021	0.005	0.179E 01	0.253E-01	4.04E 01	1.42E-01
80.	0.893	0.650	0.669E 02	0.303E 01	0.029	0.007	0.178E 01	0.253E-01	3.04E 01	1.10E-01
100.	0.913	0.701	0.533E 02	0.255E 01	0.037	0.009	0.178E 01	0.254E-01	2.44E 01	9.00E-02
120.	0.926	0.736	0.443E 02	0.220E 01	0.045	0.010	0.177E 01	0.254E-01	2.04E 01	7.73E-02
140.	0.936	0.764	0.379E 02	0.193E 01	0.053	0.012	0.176E 01	0.255E-01	1.76E 01	6.79E-02
160.	0.941	0.781	0.330E 02	0.171E 01	0.061	0.014	0.175E 01	0.255E-01	1.54E 01	6.25E-02
180.	0.946	0.795	0.293E 02	0.153E 01	0.069	0.016	0.175E 01	0.256E-01	1.38E 01	5.83E-02
200.	0.949	0.806	0.263E 02	0.139E 01	0.076	0.018	0.174E 01	0.256E-01	1.24E 01	5.50E-02
400.	0.968	0.871	0.127E 02	0.712E 00	0.150	0.038	0.167E 01	0.262E-01	6.45E 00	3.75E-02
600.	0.973	0.888	0.819E 01	0.466E-00	0.218	0.058	0.161E 01	0.268E-01	4.46E 00	3.50E-02
800.	0.973	0.889	0.594E 01	0.338E-00	0.281	0.080	0.155E 01	0.275E-01	3.46E 00	3.75E-02
1000.	0.973	0.889	0.459E 01	0.261E-00	0.340	0.103	0.150E 01	0.283E-01	2.86E 00	4.10E-02
1200.	0.973	0.888	0.370E 01	0.210E-00	0.398	0.128	0.145E 01	0.291E-01	2.44E 00	4.54E-02
1400.	0.971	0.882	0.306E 01	0.173E-00	0.453	0.156	0.140E 01	0.300E-01	2.14E 00	5.29E-02
1600.	0.967	0.867	0.258E 01	0.144E-00	0.506	0.185	0.136E 01	0.311E-01	1.91E 00	6.66E-02
1800.	0.961	0.844	0.221E 01	0.121E-00	0.559	0.220	0.132E 01	0.324E-01	1.72E 00	8.94E-02
2000.	0.950	0.808	0.190E 01	0.101E-00	0.615	0.262	0.129E 01	0.343E-01	1.54E 00	1.30E-01
2200.	0.933	0.755	0.164E 01	0.826E-01	0.680	0.321	0.127E 01	0.375E-01	1.37E 00	2.11E-01
2400.	0.901	0.670	0.139E 01	0.642E-01	0.765	0.420	0.130E 01	0.446E-01	1.18E 00	4.20E-01
2481.[e]	0.856	0.569			0.856	0.569			1.00E 00	1.00E 00
2481.[f]					0.850	0.557				
837.[g]	0.973	0.888								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
				TEMPERATURE, DEG. F 60						
20.	0.542	0.208	0.273E 03	0.654E 01	0.004	0.001	0.183E 01	0.254E-01	1.23E 02	4.60E-01
40.	0.773	0.431	0.137E 03	0.474E 01	0.012	0.003	0.182E 01	0.254E-01	6.19E 01	2.30E-01
60.	0.846	0.551	0.910E 02	0.369E 01	0.020	0.005	0.181E 01	0.255E-01	4.14E 01	1.57E-01
80.	0.881	0.622	0.681E 02	0.300E 01	0.028	0.006	0.180E 01	0.255E-01	3.12E 01	1.22E-01
100.	0.904	0.676	0.543E 02	0.253E 01	0.036	0.008	0.179E 01	0.256E-01	2.50E 01	1.00E-01
120.	0.916	0.709	0.451E 02	0.218E 01	0.044	0.010	0.179E 01	0.256E-01	2.09E 01	8.75E-02
140.	0.925	0.734	0.386E 02	0.191E 01	0.051	0.012	0.178E 01	0.257E-01	1.80E 01	7.86E-02
160.	0.933	0.755	0.337E 02	0.170E 01	0.059	0.014	0.177E 01	0.257E-01	1.58E 01	7.16E-02
180.	0.938	0.770	0.298E 02	0.153E 01	0.066	0.016	0.177E 01	0.258E-01	1.41E 01	6.67E-02
200.	0.942	0.782	0.268E 02	0.139E 01	0.074	0.017	0.176E 01	0.259E-01	1.27E 01	6.30E-02
400.	0.962	0.848	0.130E 02	0.712E 00	0.146	0.036	0.169E 01	0.264E-01	6.60E 00	4.50E-02
600.	0.967	0.868	0.837E 01	0.468E-00	0.213	0.057	0.163E 01	0.271E-01	4.55E 00	4.17E-02
800.	0.969	0.873	0.608E 01	0.342E-00	0.275	0.078	0.157E 01	0.278E-01	3.53E 00	4.31E-02
1000.	0.969	0.873	0.471E 01	0.265E-00	0.333	0.100	0.152E 01	0.285E-01	2.91E 00	4.70E-02
1200.	0.968	0.871	0.380E 01	0.213E-00	0.389	0.124	0.147E 01	0.293E-01	2.49E 00	5.21E-02
1400.	0.967	0.866	0.315E 01	0.176E-00	0.445	0.151	0.143E 01	0.303E-01	2.17E 00	6.00E-02
1600.	0.962	0.850	0.266E 01	0.146E-00	0.498	0.181	0.139E 01	0.314E-01	1.93E 00	7.50E-02
1800.	0.955	0.825	0.228E 01	0.123E-00	0.550	0.214	0.135E 01	0.327E-01	1.74E 00	1.00E-01
2000.	0.944	0.788	0.196E 01	0.102E-00	0.608	0.256	0.132E 01	0.347E-01	1.55E 00	1.43E-01
2200.	0.926	0.737	0.169E 01	0.840E-01	0.675	0.316	0.131E 01	0.381E-01	1.37E 00	2.26E-01
2400.	0.896	0.656	0.144E 01	0.659E-01	0.765	0.419	0.134E 01	0.457E-01	1.17E 00	4.43E-01
2477.[e]	0.846	0.550			0.846	0.550			1.00E 00	1.00E 00
2475.[f]					0.835	0.529				
862.[g]	0.968	0.872								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N-PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. F 70					
20.	0.477	0.169	0.277E 03	0.610E 01	0.004	0.001	0.184E 01	0.256E-01	1.27E 02	5.25E-01
40.	0.740	0.388	0.139E 03	0.454E 01	0.012	0.003	0.183E 01	0.257E-01	6.38E 01	2.62E-01
60.	0.828	0.518	0.926E 02	0.361E 01	0.019	0.004	0.183E 01	0.257E-01	4.27E 01	1.75E-01
80.	0.867	0.593	0.693E 02	0.295E 01	0.027	0.006	0.182E 01	0.258E-01	3.21E 01	1.36E-01
100.	0.889	0.640	0.553E 02	0.248E 01	0.034	0.008	0.181E 01	0.258E-01	2.58E 01	1.15E-01
120.	0.903	0.673	0.460E 02	0.214E 01	0.042	0.010	0.181E 01	0.259E-01	2.15E 01	1.02E-01
140.	0.912	0.698	0.393E 02	0.187E 01	0.049	0.011	0.180E 01	0.259E-01	1.86E 01	9.21E-02
160.	0.920	0.718	0.343E 02	0.167E 01	0.056	0.013	0.179E 01	0.260E-01	1.63E 01	8.50E-02
180.	0.926	0.734	0.304E 02	0.150E 01	0.064	0.015	0.179E 01	0.260E-01	1.45E 01	7.94E-02
200.	0.930	0.748	0.273E 02	0.137E 01	0.071	0.017	0.178E 01	0.261E-01	1.31E 01	7.50E-02
400.	0.955	0.825	0.132E 02	0.712E 00	0.141	0.035	0.171E 01	0.267E-01	6.77E 00	5.25E-02
600.	0.962	0.848	0.855E 01	0.470E-00	0.207	0.055	0.165E 01	0.273E-01	4.65E 00	4.83E-02
800.	0.964	0.855	0.622E 01	0.344E-00	0.268	0.075	0.160E 01	0.280E-01	3.59E 00	4.95E-02
1000.	0.964	0.856	0.483E 01	0.267E-00	0.326	0.097	0.155E 01	0.287E-01	2.96E 00	5.35E-02
1200.	0.963	0.853	0.390E 01	0.215E-00	0.382	0.121	0.150E 01	0.295E-01	2.52E 00	5.96E-02
1400.	0.961	0.846	0.323E 01	0.177E-00	0.436	0.147	0.145E 01	0.305E-01	2.20E 00	6.89E-02
1600.	0.957	0.833	0.274E 01	0.148E-00	0.489	0.176	0.141E 01	0.316E-01	1.96E 00	8.37E-02
1800.	0.949	0.807	0.235E 01	0.124E-00	0.542	0.209	0.138E 01	0.331E-01	1.75E 00	1.11E-01
2000.	0.938	0.770	0.203E 01	0.104E-00	0.600	0.250	0.135E 01	0.351E-01	1.56E 00	1.56E-01
2200.	0.920	0.720	0.176E 01	0.857E-01	0.670	0.311	0.134E 01	0.387E-01	1.37E 00	2.41E-01
2400.	0.889	0.640	0.150E 01	0.672E-01	0.763	0.417	0.138E 01	0.469E-01	1.16E 00	4.69E-01
2471.[e]	0.837	0.534			0.837	0.534			1.00E 00	1.00E 00
2462.[f]					0.814	0.494				
882.[g]	0.963	0.854								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N–PENTANE
				TEMPERATURE, DEG. F 80						
20.	0.404	0.131	0.281E 03	0.568E 01	0.003	0.001	0.186E 01	0.258E-01	1.31E 02	5.98E-01
40.	0.694	0.336	0.141E 03	0.425E 01	0.011	0.002	0.185E 01	0.259E-01	6.55E 01	3.09E-01
60.	0.795	0.463	0.940E 02	0.341E 01	0.018	0.004	0.185E 01	0.259E-01	4.38E 01	2.09E-01
80.	0.842	0.543	0.704E 02	0.283E 01	0.025	0.006	0.184E 01	0.260E-01	3.30E 01	1.62E-01
100.	0.872	0.602	0.562E 02	0.242E 01	0.033	0.007	0.183E 01	0.260E-01	2.65E 01	1.32E-01
120.	0.887	0.637	0.468E 02	0.209E 01	0.040	0.009	0.182E 01	0.261E-01	2.21E 01	1.17E-01
140.	0.899	0.664	0.400E 02	0.184E 01	0.047	0.011	0.182E 01	0.262E-01	1.90E 01	1.06E-01
160.	0.907	0.684	0.349E 02	0.164E 01	0.054	0.013	0.181E 01	0.262E-01	1.67E 01	9.85E-02
180.	0.913	0.701	0.309E 02	0.148E 01	0.061	0.014	0.181E 01	0.263E-01	1.49E 01	9.23E-02
200.	0.918	0.715	0.277E 02	0.135E 01	0.068	0.016	0.180E 01	0.263E-01	1.34E 01	8.75E-02
400.	0.947	0.799	0.135E 02	0.709E 00	0.137	0.034	0.174E 01	0.269E-01	6.93E 00	6.12E-02
600.	0.955	0.827	0.873E 01	0.471E-00	0.201	0.053	0.168E 01	0.275E-01	4.75E 00	5.57E-02
800.	0.958	0.835	0.635E 01	0.345E-00	0.262	0.073	0.162E 01	0.282E-01	3.66E 00	5.69E-02
1000.	0.958	0.837	0.494E 01	0.269E-00	0.318	0.094	0.157E 01	0.290E-01	3.02E 00	6.10E-02
1200.	0.958	0.834	0.400E 01	0.217E-00	0.374	0.117	0.152E 01	0.298E-01	2.56E 00	6.75E-02
1400.	0.956	0.827	0.332E 01	0.179E-00	0.427	0.142	0.148E 01	0.307E-01	2.24E 00	7.75E-02
1600.	0.951	0.812	0.281E 01	0.150E-00	0.482	0.171	0.144E 01	0.319E-01	1.97E 00	9.44E-02
1800.	0.943	0.787	0.242E 01	0.126E-00	0.535	0.204	0.141E 01	0.334E-01	1.76E 00	1.22E-01
2000.	0.932	0.753	0.209E 01	0.105E-00	0.593	0.245	0.138E 01	0.356E-01	1.57E 00	1.67E-01
2200.	0.915	0.704	0.182E 01	0.873E-01	0.663	0.305	0.137E 01	0.392E-01	1.38E 00	2.54E-01
2400.	0.882	0.624	0.156E 01	0.688E-01	0.762	0.416	0.143E 01	0.485E-01	1.16E 00	4.96E-01
2464.[e]	0.830	0.521			0.830	0.521			1.00E 00	1.00E 00
2446.[f]					0.795	0.463				
906.[g]	0.958	0.835								

See footnotes at the end of this table.

TABLE 3.4. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. F 90					
20.	0.302	0.088	0.284E 03	0.515E 01	0.002	0.000	0.188E 01	0.261E-01	1.35E 02	7.00E-01
40.	0.653	0.295	0.143E 03	0.403E 01	0.010	0.002	0.187E 01	0.261E-01	6.75E 01	3.50E-01
60.	0.758	0.410	0.954E 02	0.322E 01	0.017	0.004	0.186E 01	0.262E-01	4.52E 01	2.46E-01
80.	0.810	0.487	0.715E 02	0.268E 01	0.024	0.005	0.186E 01	0.262E-01	3.40E 01	1.95E-01
100.	0.843	0.545	0.572E 02	0.230E 01	0.031	0.007	0.185E 01	0.263E-01	2.72E 01	1.62E-01
120.	0.865	0.587	0.475E 02	0.201E 01	0.038	0.009	0.184E 01	0.263E-01	2.28E 01	1.41E-01
140.	0.881	0.621	0.406E 02	0.179E 01	0.045	0.010	0.184E 01	0.264E-01	1.96E 01	1.25E-01
160.	0.892	0.648	0.355E 02	0.161E 01	0.052	0.012	0.183E 01	0.264E-01	1.72E 01	1.14E-01
180.	0.902	0.671	0.315E 02	0.146E 01	0.059	0.014	0.182E 01	0.265E-01	1.53E 01	1.04E-01
200.	0.909	0.689	0.282E 02	0.133E 01	0.066	0.015	0.182E 01	0.266E-01	1.38E 01	9.75E-02
400.	0.940	0.778	0.138E 02	0.709E 00	0.133	0.033	0.176E 01	0.271E-01	7.08E 00	6.87E-02
600.	0.950	0.810	0.893E 01	0.474E-00	0.196	0.052	0.170E 01	0.278E-01	4.84E 00	6.17E-02
800.	0.953	0.819	0.650E 01	0.348E-00	0.256	0.071	0.164E 01	0.285E-01	3.72E 00	6.31E-02
1000.	0.953	0.819	0.505E 01	0.271E-00	0.313	0.092	0.159E 01	0.292E-01	3.05E 00	6.80E-02
1200.	0.952	0.816	0.409E 01	0.219E-00	0.367	0.114	0.155E 01	0.300E-01	2.59E 00	7.54E-02
1400.	0.949	0.806	0.341E 01	0.180E-00	0.421	0.139	0.151E 01	0.310E-01	2.26E 00	8.75E-02
1600.	0.944	0.791	0.289E 01	0.151E-00	0.472	0.166	0.147E 01	0.322E-01	2.00E 00	1.05E-01
1800.	0.938	0.770	0.249E 01	0.127E-00	0.527	0.198	0.143E 01	0.337E-01	1.78E 00	1.32E-01
2000.	0.927	0.737	0.216E 01	0.107E-00	0.586	0.240	0.141E 01	0.360E-01	1.58E 00	1.77E-01
2200.	0.908	0.688	0.188E 01	0.888E-01	0.658	0.300	0.140E 01	0.399E-01	1.38E 00	2.68E-01
2400.	0.874	0.607	0.161E 01	0.698E-01	0.760	0.413	0.149E 01	0.504E-01	1.15E 00	5.25E-01
2457.[e]	0.826	0.513			0.826	0.513			1.00E 00	1.00E 00
2419.[f]					0.772	0.430				
930.[g]	0.952	0.815								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. F 100					
20.	0.1681	0.0430	1.301E 01	2.075E-01	0.0012	0.0003	1.899E 00	2.635E-02	1.376E 02	8.329E-01
40.	0.5828	0.2370	5.492E 00	1.392E-01	0.0084	0.0019	1.892E 00	2.639E-02	6.900E 01	4.207E-01
60.	0.7140	0.3570	3.440E 00	1.072E-01	0.0155	0.0035	1.885E 00	2.645E-02	4.613E 01	2.904E-01
80.	0.7739	0.4322	2.580E 00	8.980E-02	0.0223	0.0051	1.879E 00	2.650E-02	3.467E 01	2.312E-01
100.	0.8156	0.4958	2.101E 00	7.960E-02	0.0293	0.0067	1.873E 00	2.656E-02	2.781E 01	1.900E-01
120.	0.8434	0.5449	1.808E 00	7.280E-02	0.0363	0.0083	1.866E 00	2.661E-02	2.324E 01	1.625E-01
140.	0.8616	0.5805	1.624E 00	6.820E-02	0.0431	0.0099	1.859E 00	2.666E-02	1.998E 01	1.447E-01
160.	0.8751	0.6090	1.492E 00	6.470E-02	0.0500	0.0116	1.853E 00	2.672E-02	1.751E 01	1.315E-01
180.	0.8857	0.6328	1.397E 00	6.220E-02	0.0567	0.0132	1.847E 00	2.678E-02	1.561E 01	1.212E-01
200.	0.8939	0.6520	1.318E 00	5.990E-02	0.0632	0.0148	1.841E 00	2.683E-02	1.414E 01	1.133E-01
400.	0.9307	0.7492	1.020E 00	5.120E-02	0.1286	0.0318	1.781E 00	2.742E-02	7.237E 00	7.952E-02
600.	0.9434	0.7875	9.226E-01	4.800E-02	0.1912	0.0499	1.722E 00	2.804E-02	4.935E 00	7.000E-02
800.	0.9466	0.7977	8.758E-01	4.600E-02	0.2508	0.0693	1.669E 00	2.873E-02	3.775E 00	7.125E-02
1000.	0.9473	0.7998	8.379E-01	4.410E-02	0.3065	0.0895	1.620E 00	2.947E-02	3.091E 00	7.600E-02
1200.	0.9456	0.7945	8.135E-01	4.260E-02	0.3600	0.1112	1.574E 00	3.030E-02	2.627E 00	8.500E-02
1400.	0.9432	0.7870	7.980E-01	4.150E-02	0.4114	0.1345	1.534E 00	3.127E-02	2.293E 00	9.643E-02
1600.	0.9385	0.7724	7.875E-01	4.040E-02	0.4653	0.1621	1.495E 00	3.247E-02	2.017E 00	1.150E-01
1800.	0.9313	0.7508	7.801E-01	3.920E-02	0.5204	0.1944	1.461E 00	3.402E-02	1.789E 00	1.433E-01
2000.	0.9207	0.7207	7.808E-01	3.810E-02	0.5803	0.2352	1.441E 00	3.640E-02	1.586E 00	1.890E-01
2200.	0.9026	0.6733	7.915E-01	3.680E-02	0.6538	0.2958	1.439E 00	4.057E-02	1.380E 00	2.814E-01
2400.	0.8663	0.5903	8.359E-01	3.550E-02	0.7593	0.4123	1.558E 00	5.274E-02	1.141E 00	5.556E-01
2449.[e]	0.823	0.509	0.155E 01	0.598E-01	0.823	0.509	0.155E 01	0.598E-01	1.000E 00	1.000E 00
2384.[f]					0.747	0.397				
951.[g]	0.947	0.799								

See footnotes at the end of this table.

TABLE 3.4. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
				TEMPERATURE, DEG. F 110						
20.	0.0503	0.0116	2.901E 02	4.184E 00	0.0004	0.0001	1.921E 00	2.663E-02	1.415E 02	9.500E-01
40.	0.5285	0.1995	1.464E 02	3.446E 00	0.0074	0.0017	1.913E 00	2.667E-02	7.095E 01	4.750E-01
60.	0.6714	0.3124	9.789E 01	2.839E 00	0.0142	0.0032	1.907E 00	2.672E-02	4.737E 01	3.333E-01
80.	0.7392	0.3865	7.345E 01	2.394E 00	0.0207	0.0047	1.900E 00	2.677E-02	3.562E 01	2.664E-01
100.	0.7861	0.4496	5.875E 01	2.095E 00	0.0275	0.0062	1.894E 00	2.682E-02	2.858E 01	2.200E-01
120.	0.8149	0.4946	4.892E 01	1.851E 00	0.0342	0.0078	1.886E 00	2.686E-02	2.385E 01	1.917E-01
140.	0.8356	0.5305	4.187E 01	1.657E 00	0.0408	0.0094	1.881E 00	2.692E-02	2.050E 01	1.714E-01
160.	0.8511	0.5597	3.656E 01	1.499E 00	0.0473	0.0109	1.875E 00	2.698E-02	1.799E 01	1.562E-01
180.	0.8633	0.5842	3.244E 01	1.368E 00	0.0539	0.0125	1.868E 00	2.702E-02	1.601E 01	1.444E-01
200.	0.8732	0.6048	2.914E 01	1.258E 00	0.0604	0.0141	1.863E 00	2.709E-02	1.444E 01	1.350E-01
400.	0.9190	0.7162	1.424E 01	6.920E-01	0.1248	0.0307	1.803E 00	2.767E-02	7.365E 00	9.250E-02
600.	0.9336	0.7576	9.264E 00	4.686E-01	0.1867	0.0485	1.746E 00	2.830E-02	5.002E 00	8.167E-02
800.	0.9387	0.7730	6.769E 00	3.475E-01	0.2457	0.0675	1.692E 00	2.898E-02	3.821E 00	8.125E-02
1000.	0.9406	0.7788	5.280E 00	2.725E-01	0.3012	0.0875	1.642E 00	2.971E-02	3.123E 00	8.500E-02
1200.	0.9392	0.7744	4.287E 00	2.203E-01	0.3538	0.1085	1.598E 00	3.056E-02	2.654E 00	9.417E-02
1400.	0.9363	0.7657	3.576E 00	1.823E-01	0.4053	0.1316	1.559E 00	3.155E-02	2.310E 00	1.071E-01
1600.	0.9308	0.7494	3.034E 00	1.523E-01	0.4559	0.1570	1.527E 00	3.278E-02	2.042E 00	1.272E-01
1800.	0.9228	0.7267	2.614E 00	1.283E-01	0.5127	0.1896	1.491E 00	3.436E-02	1.800E 00	1.583E-01
2000.	0.9119	0.6971	2.276E 00	1.084E-01	0.5753	0.2315	1.468E 00	3.683E-02	1.585E 00	2.075E-01
2200.	0.8948	0.6541	1.989E 00	9.062E-02	0.6492	0.2916	1.477E 00	4.135E-02	1.378E 00	3.000E-01
2400.	0.8553	0.5679	1.704E 00	7.053E-02	0.7608	0.4143	1.616E 00	5.486E-02	1.124E 00	6.050E-01
2437.[e,f]	0.813	0.491	0.162E 01	0.610E-01	0.813	0.491	0.162E 01	0.610E-01	1.000E 00	1.000E 00
2345.[f]					0.720	0.364				
975.[g]	0.940	0.776								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
				TEMPERATURE, DEG. F 120						
40.	0.4207	0.1390	1.476E 02	3.041E 00	0.0058	0.0013	1.935E 00	2.694E-02	7.267E 01	5.827E-01
60.	0.6050	0.2540	9.889E 01	2.588E 00	0.0125	0.0028	1.928E 00	2.699E-02	4.852E 01	4.000E-01
80.	0.6934	0.3346	7.428E 01	2.234E 00	0.0190	0.0043	1.922E 00	2.704E-02	3.647E 01	3.125E-01
100.	0.7487	0.3985	5.947E 01	1.973E 00	0.0256	0.0058	1.916E 00	2.709E-02	2.923E 01	2.579E-01
120.	0.7836	0.4460	4.956E 01	1.758E 00	0.0321	0.0073	1.909E 00	2.714E-02	2.441E 01	2.236E-01
140.	0.8077	0.4829	4.244E 01	1.582E 00	0.0386	0.0088	1.903E 00	2.719E-02	2.095E 01	2.000E-01
160.	0.8269	0.5151	3.708E 01	1.440E 00	0.0450	0.0104	1.897E 00	2.725E-02	1.837E 01	1.812E-01
180.	0.8419	0.5422	3.290E 01	1.321E 00	0.0515	0.0119	1.891E 00	2.730E-02	1.635E 01	1.667E-01
200.	0.8540	0.5653	2.957E 01	1.220E 00	0.0579	0.0135	1.884E 00	2.735E-02	1.474E 01	1.550E-01
400.	0.9055	0.6806	1.448E 01	6.786E-01	0.1210	0.0297	1.827E 00	2.795E-02	7.485E 00	1.075E-01
600.	0.9236	0.7289	9.439E 00	4.643E-01	0.1818	0.0471	1.771E 00	2.858E-02	5.082E 00	9.333E-02
800.	0.9307	0.7492	6.907E 00	3.466E-01	0.2409	0.0659	1.715E 00	2.925E-02	3.864E 00	9.125E-02
1000.	0.9324	0.7542	5.390E 00	2.717E-01	0.2960	0.0855	1.665E 00	2.998E-02	3.150E 00	9.600E-02
1200.	0.9315	0.7515	4.381E 00	2.203E-01	0.3477	0.1060	1.624E 00	3.084E-02	2.679E 00	1.050E-01
1400.	0.9287	0.7432	3.654E 00	1.823E-01	0.3983	0.1283	1.586E 00	3.185E-02	2.331E 00	1.186E-01
1600.	0.9230	0.7272	3.102E 00	1.523E-01	0.4501	0.1540	1.551E 00	3.308E-02	2.051E 00	1.400E-01
1800.	0.9148	0.7047	2.675E 00	1.285E-01	0.5051	0.1850	1.522E 00	3.474E-02	1.811E 00	1.722E-01
2000.	0.9024	0.6728	2.327E 00	1.082E-01	0.5683	0.2264	1.501E 00	3.728E-02	1.588E 00	2.260E-01
2200.	0.8831	0.6269	2.028E 00	8.972E-02	0.6412	0.2844	1.524E 00	4.214E-02	1.377E 00	3.257E-01
2400.	0.8443	0.5465	1.744E 00	7.039E-02	0.7719	0.4294	1.662E 00	5.761E-02	1.094E 00	6.828E-01
2424.[e]	0.807	0.482	0.166E 01	0.617E-01	0.807	0.482	0.166E 01	0.617E-01	1.000E 00	1.000E 00
2299.[f]					0.692	0.333				
998.[g]	0.932	0.754								
				TEMPERATURE, DEG. F 130						
40.	0.3280	0.0979	1.489E 02	2.769E 00	0.0044	0.0010	1.957E 00	2.722E-02	7.372E 01	6.750E-01
60.	0.5423	0.2085	9.983E 01	2.393E 00	0.0110	0.0025	1.951E 00	2.727E-02	4.922E 01	4.628E-01
80.	0.6438	0.2867	7.503E 01	2.083E 00	0.0174	0.0039	1.944E 00	2.732E-02	3.699E 01	3.625E-01
100.	0.7121	0.3548	6.016E 01	1.868E 00	0.0240	0.0054	1.938E 00	2.737E-02	2.965E 01	2.950E-01
120.	0.7522	0.4030	5.017E 01	1.675E 00	0.0304	0.0069	1.932E 00	2.742E-02	2.475E 01	2.555E-01
140.	0.7810	0.4422	4.298E 01	1.517E 00	0.0368	0.0084	1.926E 00	2.748E-02	2.124E 01	2.274E-01
160.	0.8014	0.4729	3.756E 01	1.382E 00	0.0430	0.0099	1.920E 00	2.753E-02	1.862E 01	2.075E-01
180.	0.8178	0.4995	3.334E 01	1.269E 00	0.0493	0.0114	1.914E 00	2.759E-02	1.658E 01	1.917E-01
200.	0.8300	0.5205	2.996E 01	1.171E 00	0.0555	0.0129	1.909E 00	2.765E-02	1.494E 01	1.800E-01
400.	0.8910	0.6450	1.472E 01	6.643E-01	0.1174	0.0287	1.850E 00	2.822E-02	7.587E 00	1.235E-01
600.	0.9123	0.6981	9.610E 00	4.584E-01	0.1776	0.0458	1.794E 00	2.885E-02	5.137E 00	1.067E-01
800.	0.9207	0.7209	7.037E 00	3.434E-01	0.2359	0.0642	1.739E 00	2.952E-02	3.902E 00	1.037E-01
1000.	0.9233	0.7281	5.496E 00	2.701E-01	0.2901	0.0833	1.691E 00	3.026E-02	3.183E 00	1.080E-01
1200.	0.9227	0.7262	4.468E 00	2.192E-01	0.3417	0.1035	1.649E 00	3.113E-02	2.700E 00	1.175E-01
1400.	0.9195	0.7175	3.729E 00	1.814E-01	0.3909	0.1249	1.615E 00	3.216E-02	2.352E 00	1.321E-01
1600.	0.9138	0.7022	3.166E 00	1.516E-01	0.4419	0.1497	1.584E 00	3.345E-02	2.068E 00	1.544E-01
1800.	0.9052	0.6798	2.730E 00	1.278E-01	0.4997	0.1817	1.549E 00	3.512E-02	1.812E 00	1.894E-01
2000.	0.8920	0.6473	2.375E 00	1.074E-01	0.5626	0.2224	1.533E 00	3.778E-02	1.585E 00	2.470E-01
2200.	0.8708	0.5997	2.066E 00	8.868E-02	0.6396	0.2830	1.554E 00	4.286E-02	1.361E 00	3.586E-01
2400.	0.8192	0.5019	1.752E 00	6.689E-02	0.7802	0.4411	1.789E 00	6.305E-02	1.050E 00	8.225E-01
2409.[e]	0.799	0.470	0.171E 01	0.625E-01	0.799	0.470	0.171E 01	0.625E-01	1.000E 00	1.000E 00
2248.[f]					0.663	0.304				
1022.[g]	0.924	0.729								

See footnotes at the end of this table.

TABLE 3.4. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N-PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. F 140					
40.	0.2090	0.0555	1.497E 02	2.477E 00	0.0028	0.0006	1.980E 00	2.750E-02	7.500E 01	7.932E-01
60.	0.4634	0.1611	1.006E 02	2.179E 00	0.0093	0.0021	1.974E 00	2.756E-02	5.005E 01	5.416E-01
80.	0.5889	0.2416	7.569E 01	1.935E 00	0.0157	0.0035	1.967E 00	2.760E-02	3.761E 01	4.176E-01
100.	0.6619	0.3033	6.071E 01	1.734E 00	0.0220	0.0050	1.961E 00	2.765E-02	3.013E 01	3.457E-01
120.	0.7127	0.3555	5.069E 01	1.576E 00	0.0284	0.0064	1.955E 00	2.771E-02	2.513E 01	2.957E-01
140.	0.7489	0.3987	4.347E 01	1.443E 00	0.0347	0.0079	1.949E 00	2.776E-02	2.157E 01	2.601E-01
160.	0.7754	0.4343	3.802E 01	1.327E 00	0.0410	0.0094	1.942E 00	2.781E-02	1.889E 01	2.342E-01
180.	0.7950	0.4630	3.377E 01	1.226E 00	0.0473	0.0109	1.936E 00	2.786E-02	1.682E 01	2.152E-01
200.	0.8107	0.4878	3.036E 01	1.139E 00	0.0535	0.0124	1.930E 00	2.791E-02	1.515E 01	2.000E-01
400.	0.8771	0.6134	1.495E 01	6.519E-01	0.1142	0.0279	1.872E 00	2.848E-02	7.680E 00	1.387E-01
600.	0.9008	0.6688	9.771E 00	4.522E-01	0.1735	0.0446	1.818E 00	2.912E-02	5.192E 00	1.200E-01
800.	0.9101	0.6925	7.161E 00	3.396E-01	0.2311	0.0627	1.764E 00	2.981E-02	3.937E 00	1.169E-01
1000.	0.9143	0.7034	5.599E 00	2.685E-01	0.2857	0.0817	1.715E 00	3.056E-02	3.200E 00	1.200E-01
1200.	0.9140	0.7027	4.553E 00	2.182E-01	0.3363	0.1013	1.675E 00	3.144E-02	2.717E 00	1.296E-01
1400.	0.9112	0.6952	3.800E 00	1.807E-01	0.3860	0.1226	1.641E 00	3.249E-02	2.361E 00	1.446E-01
1600.	0.9049	0.6790	3.229E 00	1.510E-01	0.4364	0.1469	1.612E 00	3.381E-02	2.074E 00	1.687E-01
1800.	0.8952	0.6551	2.782E 00	1.269E-01	0.4943	0.1785	1.582E 00	3.562E-02	1.811E 00	2.072E-01
2000.	0.8813	0.6227	2.421E 00	1.066E-01	0.5578	0.2190	1.566E 00	3.832E-02	1.580E 00	2.685E-01
2200.	0.8585	0.5744	2.100E 00	8.759E-02	0.6390	0.2824	1.589E 00	4.377E-02	1.344E 00	3.918E-01
2390.[e]	0.790	0.456	0.176E 01	0.632E-01	0.790	0.456	0.176E 01	0.632E-01	1.000E 00	1.000E 00
2197.[f]					0.633	0.277				
1044.[g]	0.914	0.704								
					TEMPERATURE, DEG. F 150					
40.	0.1012	0.0244	1.623E 02	2.442E 00	0.0013	0.0003	2.018E-01	2.800E-03	7.580E 01	9.000E-01
60.	0.3801	0.1200	1.083E 02	2.130E 00	0.0075	0.0017	1.998E 00	2.785E-02	5.062E 01	6.246E-01
80.	0.5214	0.1950	7.618E 01	1.776E 00	0.0137	0.0031	1.992E 00	2.790E-02	3.800E 01	4.853E-01
100.	0.6136	0.2610	6.122E 01	1.623E 00	0.0202	0.0046	1.985E 00	2.795E-02	3.043E 01	3.943E-01
120.	0.6755	0.3164	5.119E 01	1.495E 00	0.0266	0.0060	1.978E 00	2.800E-02	2.540E 01	3.333E-01
140.	0.7158	0.3590	4.392E 01	1.373E 00	0.0328	0.0075	1.972E 00	2.805E-02	2.179E 01	2.938E-01
160.	0.7452	0.3940	3.843E 01	1.267E 00	0.0390	0.0090	1.966E 00	2.810E-02	1.909E 01	2.652E-01
180.	0.7666	0.4220	3.416E 01	1.172E 00	0.0451	0.0104	1.960E 00	2.815E-02	1.699E 01	2.444E-01
200.	0.7842	0.4468	3.073E 01	1.091E 00	0.0512	0.0119	1.954E 00	2.820E-02	1.530E 01	2.275E-01
400.	0.8634	0.5842	1.518E 01	6.401E-01	0.1114	0.0271	1.895E 00	2.875E-02	7.752E 00	1.537E-01
600.	0.8908	0.6445	9.934E 00	4.480E-01	0.1703	0.0436	1.840E 00	2.940E-02	5.232E 00	1.317E-01
800.	0.9002	0.6673	7.287E 00	3.367E-01	0.2272	0.0614	1.788E 00	3.010E-02	3.962E 00	1.291E-01
1000.	0.9036	0.6758	5.698E 00	2.656E-01	0.2808	0.0799	1.742E 00	3.089E-02	3.218E 00	1.340E-01
1200.	0.9034	0.6753	4.630E 00	2.158E-01	0.3301	0.0988	1.704E 00	3.178E-02	2.737E 00	1.442E-01
1400.	0.9002	0.6673	3.862E 00	1.784E-01	0.3792	0.1196	1.671E 00	3.285E-02	2.374E 00	1.607E-01
1600.	0.8944	0.6531	3.287E 00	1.496E-01	0.4310	0.1442	1.640E 00	3.420E-02	2.075E 00	1.856E-01
1800.	0.8846	0.6303	2.833E 00	1.258E-01	0.4884	0.1751	1.611E 00	3.601E-02	1.811E 00	2.256E-01
2000.	0.8685	0.5948	2.459E 00	1.050E-01	0.5533	0.2160	1.600E 00	3.893E-02	1.569E 00	2.945E-01
2200.	0.8437	0.5455	2.130E 00	8.586E-02	0.6378	0.2814	1.631E 00	4.484E-02	1.323E 00	4.316E-01
2367.[e]	0.779	0.440	0.181E 01	0.638E-01	0.779	0.440	0.181E 01	0.638E-01	1.000E 00	1.000E 00
2140.[f]					0.602	0.252				
1066.[g]	0.904	0.676								

See footnotes at the end of this table.

TABLE 34. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. F 160					
60.	0.2986	0.0865	9.168E 00	1.655E-01	0.0058	0.0013	2.023E 00	2.816E-02	5.108E 01	7.055E-01
80.	0.4530	0.1555	6.520E 00	1.395E-01	0.0118	0.0027	2.016E 00	2.820E-02	3.835E 01	5.535E-01
100.	0.5582	0.2193	4.871E 00	1.193E-01	0.0182	0.0041	2.009E 00	2.825E-02	3.070E 01	4.500E-01
120.	0.6269	0.2720	3.838E 00	1.038E-01	0.0245	0.0055	2.003E 00	2.830E-02	2.561E 01	3.825E-01
140.	0.6760	0.3169	3.207E 00	9.370E-02	0.0308	0.0070	1.997E 00	2.835E-02	2.196E 01	3.343E-01
160.	0.7096	0.3520	2.765E 00	8.550E-02	0.0369	0.0084	1.990E 00	2.840E-02	1.924E 01	3.016E-01
180.	0.7358	0.3824	2.439E 00	7.900E-02	0.0430	0.0099	1.984E 00	2.845E-02	1.712E 01	2.761E-01
200.	0.7558	0.4076	2.189E 00	7.360E-02	0.0490	0.0113	1.979E 00	2.851E-02	1.541E 01	2.568E-01
400.	0.8485	0.5546	1.235E 00	5.030E-02	0.1088	0.0264	1.920E 00	2.907E-02	7.800E 00	1.700E-01
600.	0.8769	0.6129	1.003E 00	4.370E-02	0.1670	0.0427	1.865E 00	2.971E-02	5.250E 00	1.478E-01
800.	0.8894	0.6413	9.100E-01	4.090E-02	0.2237	0.0602	1.814E 00	3.043E-02	3.975E 00	1.425E-01
1000.	0.8933	0.6506	8.591E-01	3.900E-02	0.2767	0.0784	1.769E 00	3.124E-02	3.228E 00	1.475E-01
1200.	0.8939	0.6519	8.359E-01	3.800E-02	0.3261	0.0972	1.731E 00	3.215E-02	2.741E 00	1.575E-01
1400.	0.8911	0.6453	8.219E-01	3.710E-02	0.3751	0.1177	1.700E 00	3.326E-02	2.376E 00	1.743E-01
1600.	0.8852	0.6315	8.118E-01	3.610E-02	0.4258	0.1416	1.671E 00	3.463E-02	2.079E 00	2.000E-01
1800.	0.8738	0.6063	8.139E-01	3.520E-02	0.4826	0.1718	1.647E 00	3.654E-02	1.811E 00	2.439E-01
2000.	0.8576	0.5724	8.268E-01	3.440E-02	0.5504	0.2140	1.635E 00	3.961E-02	1.558E 00	3.168E-01
2200.	0.8273	0.5158	8.672E-01	3.370E-02	0.6382	0.2817	1.674E 00	4.605E-02	1.296E 00	4.773E-01
2340.[e,f]	0.766	0.422	0.187E 01	0.643E-01	0.766	0.422	0.187E 01	0.643E-01	1.000E 00	1.000E 00
2084.[f]					0.577	0.233				
1086.[g]	0.892	0.648								
					TEMPERATURE, DEG. F 170					
60.	0.1863	0.0484	1.018E 02	1.650E 00	0.0036	0.0008	2.048E 00	2.846E-02	5.115E 01	8.167E-01
80.	0.3757	0.1180	7.687E 01	1.505E 00	0.0098	0.0022	2.041E 00	2.850E-02	3.839E 01	6.305E-01
100.	0.4882	0.1750	6.188E 01	1.383E 00	0.0159	0.0036	2.034E 00	2.855E-02	3.073E 01	5.200E-01
120.	0.5705	0.2280	5.185E 01	1.292E 00	0.0222	0.0050	2.028E 00	2.860E-02	2.564E 01	4.393E-01
140.	0.6293	0.2740	4.459E 01	1.210E 00	0.0286	0.0065	2.021E 00	2.865E-02	2.200E 01	3.816E-01
160.	0.6715	0.3125	3.910E 01	1.134E 00	0.0349	0.0080	2.015E 00	2.870E-02	1.927E 01	3.403E-01
180.	0.7022	0.3439	3.480E 01	1.063E 00	0.0410	0.0094	2.009E 00	2.876E-02	1.714E 01	3.106E-01
200.	0.7249	0.3695	3.134E 01	9.957E-01	0.0469	0.0108	2.004E 00	2.882E-02	1.545E 01	2.886E-01
400.	0.8279	0.5168	1.557E 01	6.058E-01	0.1060	0.0257	1.946E 00	2.939E-02	7.812E 00	1.925E-01
600.	0.8606	0.5786	1.021E 01	4.279E-01	0.1637	0.0417	1.893E 00	3.006E-02	5.258E 00	1.667E-01
800.	0.8742	0.6070	7.500E 00	3.246E-01	0.2196	0.0589	1.843E 00	3.080E-02	3.981E 00	1.612E-01
1000.	0.8783	0.6160	5.865E 00	2.564E-01	0.2720	0.0767	1.798E 00	3.161E-02	3.229E 00	1.672E-01
1200.	0.8789	0.6175	4.766E 00	2.087E-01	0.3212	0.0952	1.762E 00	3.255E-02	2.737E 00	1.783E-01
1400.	0.8767	0.6126	3.977E 00	1.732E-01	0.3702	0.1156	1.731E 00	3.369E-02	2.369E 00	1.957E-01
1600.	0.8715	0.6013	3.386E 00	1.456E-01	0.4209	0.1391	1.705E 00	3.512E-02	2.071E 00	2.219E-01
1800.	0.8613	0.5800	2.923E 00	1.227E-01	0.4778	0.1690	1.684E 00	3.713E-02	1.803E 00	2.656E-01
2000.	0.8405	0.5395	2.529E 00	1.012E-01	0.5461	0.2111	1.680E 00	4.046E-02	1.539E 00	3.515E-01
2200.	0.8075	0.4827	2.180E 00	8.123E-02	0.6430	0.2860	1.733E 00	4.804E-02	1.256E 00	5.391E-01
2309.[e,f]	0.754	0.405	0.193E 01	0.646E-01	0.754	0.405	0.193E 01	0.646E-01	1.000E 00	1.000E 00
2025.[f]					0.555	0.217				
1104.[g]	0.879	0.617								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
				TEMPERATURE, DEG. F 180						
60.	0.0509	0.0118	1.015E 02	1.465E 00	0.0010	0.0002	2.074E 00	2.877E-02	5.107E 01	9.500E-01
80.	0.2803	0.0797	7.691E 01	1.363E 00	0.0073	0.0016	2.068E 00	2.882E-02	3.834E 01	7.250E-01
100.	0.4180	0.1377	6.207E 01	1.275E 00	0.0136	0.0031	2.061E 00	2.887E-02	3.070E 01	5.900E-01
120.	0.5100	0.1879	5.204E 01	1.195E 00	0.0199	0.0045	2.054E 00	2.892E-02	2.560E 01	5.000E-01
140.	0.5746	0.2310	4.479E 01	1.122E 00	0.0262	0.0059	2.048E 00	2.898E-02	2.196E 01	4.368E-01
160.	0.6221	0.2680	3.931E 01	1.055E 00	0.0323	0.0074	2.042E 00	2.903E-02	1.924E 01	3.905E-01
180.	0.6581	0.2997	3.500E 01	9.937E-01	0.0384	0.0088	2.035E 00	2.908E-02	1.712E 01	3.556E-01
200.	0.6847	0.3256	3.154E 01	9.349E-01	0.0444	0.0102	2.031E 00	2.915E-02	1.541E 01	3.300E-01
400.	0.8049	0.4784	1.572E 01	5.826E-01	0.1030	0.0249	1.974E 00	2.974E-02	7.815E 00	2.175E-01
600.	0.8432	0.5447	1.033E 01	4.160E-01	0.1603	0.0407	1.920E 00	3.040E-02	5.262E 00	1.867E-01
800.	0.8578	0.5729	7.591E 00	3.160E-01	0.2155	0.0576	1.871E 00	3.116E-02	3.980E 00	1.812E-01
1000.	0.8646	0.5867	5.943E 00	2.514E-01	0.2680	0.0753	1.828E 00	3.201E-02	3.226E 00	1.850E-01
1200.	0.8647	0.5869	4.822E 00	2.040E-01	0.3177	0.0938	1.793E 00	3.300E-02	2.722E 00	1.983E-01
1400.	0.8630	0.5835	4.028E 00	1.698E-01	0.3661	0.1138	1.764E 00	3.419E-02	2.357E 00	2.161E-01
1600.	0.8575	0.5722	3.430E 00	1.427E-01	0.4183	0.1378	1.736E 00	3.567E-02	2.050E 00	2.450E-01
1800.	0.8467	0.5511	2.959E 00	1.200E-01	0.4762	0.1682	1.718E 00	3.782E-02	1.778E 00	2.928E-01
2000.	0.8249	0.5117	2.558E 00	9.890E-02	0.5445	0.2100	1.723E 00	4.143E-02	1.515E 00	3.843E-01
2200.	0.7862	0.4498	2.203E 00	7.858E-02	0.6500	0.2922	1.816E 00	5.088E-02	1.209E 00	6.109E-01
2275.[e]	0.739	0.387	0.199E 01	0.649E-01	0.739	0.387	0.199E 01	0.649E-01	1.000E 00	1.000E 00
1965.[f]					0.531	0.201				
1120.[g]	0.865	0.588								
				TEMPERATURE, DEG. F 190						
80.	0.1865	0.0485	7.687E 01	1.246E 00	0.0049	0.0011	2.095E 00	2.915E-02	3.835E 01	8.175E-01
100.	0.3430	0.1040	6.211E 01	1.174E 00	0.0112	0.0025	2.089E 00	2.920E-02	3.070E 01	6.645E-01
120.	0.4431	0.1503	5.213E 01	1.102E 00	0.0173	0.0039	2.082E 00	2.925E-02	2.560E 01	5.667E-01
140.	0.5134	0.1900	4.487E 01	1.035E 00	0.0234	0.0053	2.076E 00	2.930E-02	2.196E 01	4.983E-01
160.	0.5694	0.2272	3.943E 01	9.808E-01	0.0296	0.0067	2.069E 00	2.935E-02	1.924E 01	4.437E-01
180.	0.6118	0.2595	3.515E 01	9.294E-01	0.0357	0.0082	2.063E 00	2.941E-02	1.712E 01	4.026E-01
200.	0.6455	0.2882	3.172E 01	8.826E-01	0.0419	0.0096	2.057E 00	2.947E-02	1.541E 01	3.700E-01
400.	0.7795	0.4401	1.585E 01	5.579E-01	0.0999	0.0241	2.001E 00	3.007E-02	7.805E 00	2.450E-01
600.	0.8243	0.5106	1.044E 01	4.032E-01	0.1569	0.0397	1.949E 00	3.077E-02	5.255E 00	2.083E-01
800.	0.8413	0.5411	7.677E 00	3.078E-01	0.2117	0.0563	1.902E 00	3.156E-02	3.975E 00	2.012E-01
1000.	0.8484	0.5545	6.002E 00	2.445E-01	0.2643	0.0740	1.860E 00	3.245E-02	3.210E 00	2.060E-01
1200.	0.8490	0.5555	4.873E 00	1.988E-01	0.3135	0.0922	1.827E 00	3.348E-02	2.708E 00	2.200E-01
1400.	0.8460	0.5498	4.064E 00	1.646E-01	0.3621	0.1121	1.800E 00	3.473E-02	2.336E 00	2.414E-01
1600.	0.8395	0.5376	3.461E 00	1.381E-01	0.4135	0.1355	1.777E 00	3.630E-02	2.030E 00	2.737E-01
1800.	0.8287	0.5182	2.983E 00	1.163E-01	0.4720	0.1658	1.764E 00	3.863E-02	1.756E 00	3.244E-01
2000.	0.8061	0.4804	2.576E 00	9.569E-02	0.5445	0.2100	1.775E 00	4.266E-02	1.480E 00	4.256E-01
2200.	0.7509	0.4013	2.185E 00	7.277E-02	0.6605	0.3020	1.962E 00	5.590E-02	1.137E 00	7.338E-01
2234.[e]	0.724	0.369	0.205E 01	0.651E-01	0.724	0.369	0.205E 01	0.651E-01	1.000E 00	1.000E 00
1904.[f]					0.508	0.187				
1134.[g]	0.850	0.557								

See footnotes at the end of this table.

TABLE 3.4. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N–PENTANE
				TEMPERATURE, DEG. F 200						
80.	0.0769	0.0182	7.657E 01	1.129E 00	0.0020	0.0004	2.124E 00	2.948E-02	3.824E 01	9.250E-01
100.	0.2563	0.0712	6.204E 01	1.074E 00	0.0084	0.0019	2.117E 00	2.953E-02	3.060E 01	7.500E-01
120.	0.3676	0.1144	5.208E 01	1.011E 00	0.0144	0.0032	2.111E 00	2.959E-02	2.552E 01	6.417E-01
140.	0.4472	0.1525	4.488E 01	9.538E-01	0.0204	0.0046	2.105E 00	2.964E-02	2.189E 01	5.643E-01
160.	0.5071	0.1862	3.944E 01	9.026E-01	0.0264	0.0060	2.099E 00	2.970E-02	1.917E 01	5.062E-01
180.	0.5566	0.2182	3.520E 01	8.601E-01	0.0326	0.0074	2.093E 00	2.976E-02	1.706E 01	4.583E-01
200.	0.5914	0.2434	3.176E 01	8.151E-01	0.0385	0.0088	2.088E 00	2.983E-02	1.535E 01	4.250E-01
400.	0.7539	0.4052	1.596E 01	5.347E-01	0.0968	0.0233	2.032E 00	3.046E-02	7.785E 00	2.725E-01
600.	0.8023	0.4744	1.053E 01	3.881E-01	0.1529	0.0386	1.982E 00	3.117E-02	5.247E 00	2.333E-01
800.	0.8238	0.5096	7.755E 00	2.990E-01	0.2079	0.0551	1.935E 00	3.199E-02	3.962E 00	2.225E-01
1000.	0.8322	0.5244	6.061E 00	2.381E-01	0.2608	0.0727	1.893E 00	3.291E-02	3.191E 00	2.270E-01
1200.	0.8334	0.5266	4.917E 00	1.936E-01	0.3106	0.0910	1.861E 00	3.401E-02	2.683E 00	2.417E-01
1400.	0.8311	0.5224	4.102E 00	1.607E-01	0.3608	0.1115	1.834E 00	3.533E-02	2.304E 00	2.643E-01
1600.	0.8230	0.5083	3.487E 00	1.342E-01	0.4124	0.1350	1.815E 00	3.704E-02	1.996E 00	3.012E-01
1800.	0.8110	0.4883	3.000E 00	1.126E-01	0.4702	0.1648	1.811E 00	3.957E-02	1.725E 00	3.567E-01
2000.[e]	0.7878	0.4523	2.590E 00	9.266E-02	0.5513	0.2146	1.825E 00	4.427E-02	1.429E 00	4.728E-01
2188.[f]	0.707	0.349	0.212E 01	0.652E-01	0.707	0.349	0.212E 01	0.652E-01	1.000E 00	1.000E 00
1840.[g]					0.486	0.174				
1144.[g]	0.834	0.527								
				TEMPERATURE, DEG. F 210						
100.	0.1543	0.0390	6.171E 01	9.719E-01	0.0051	0.0011	2.147E 00	2.988E-02	3.039E 01	8.500E-01
120.	0.2879	0.0825	5.192E 01	9.272E-01	0.0114	0.0025	2.140E 00	2.993E-02	2.533E 01	7.202E-01
140.	0.3779	0.1190	4.478E 01	8.789E-01	0.0174	0.0039	2.135E 00	3.000E-02	2.173E 01	6.331E-01
160.	0.4425	0.1500	3.937E 01	8.319E-01	0.0232	0.0053	2.130E 00	3.006E-02	1.904E 01	5.708E-01
180.	0.4930	0.1778	3.514E 01	7.898E-01	0.0291	0.0066	2.124E 00	3.012E-02	1.694E 01	5.222E-01
200.	0.5354	0.2040	3.176E 01	7.544E-01	0.0351	0.0080	2.118E 00	3.018E-02	1.526E 01	4.814E-01
400.	0.7235	0.3678	1.604E 01	5.081E-01	0.0934	0.0224	2.064E 00	3.084E-02	7.750E 00	3.050E-01
600.	0.7787	0.4390	1.060E 01	3.726E-01	0.1490	0.0375	2.015E 00	3.159E-02	5.227E 00	2.600E-01
800.	0.8040	0.4770	7.821E 00	2.892E-01	0.2040	0.0539	1.970E 00	3.245E-02	3.941E 00	2.462E-01
1000.	0.8142	0.4935	6.109E 00	2.308E-01	0.2568	0.0714	1.929E 00	3.341E-02	3.170E 00	2.500E-01
1200.	0.8165	0.4974	4.954E 00	1.881E-01	0.3076	0.0899	1.898E 00	3.458E-02	2.654E 00	2.650E-01
1400.	0.8136	0.4925	4.129E 00	1.558E-01	0.3589	0.1107	1.873E 00	3.600E-02	2.267E 00	2.907E-01
1600.	0.8056	0.4795	3.508E 00	1.302E-01	0.4109	0.1343	1.857E 00	3.783E-02	1.961E 00	3.300E-01
1800.	0.7924	0.4591	3.012E 00	1.088E-01	0.4701	0.1648	1.863E 00	4.070E-02	1.686E 00	3.918E-01
2000.[e]	0.7678	0.4237	2.593E 00	8.921E-02	0.5594	0.2202	1.894E 00	4.646E-02	1.372E 00	5.270E-01
2135.[f]	0.689	0.330	0.219E 01	0.653E-01	0.689	0.330	0.219E 01	0.653E-01	1.000E 00	1.000E 00
1781.[g]					0.465	0.162				
1151.[g]	0.816	0.497								

See footnotes at the end of this table.

TABLE 3.4. PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT MOLE F METHANE	DEW POINT WT F METHANE	DEW POINT VOLUME MOLAL[c]	DEW POINT VOLUME SPECIFIC[d]	BUBBLE POINT MOLE F METHANE	BUBBLE POINT WT F METHANE	BUBBLE POINT VOLUME MOLAL[c]	BUBBLE POINT VOLUME SPECIFIC[d]	EQUILIBRIUM RATIO[b] METHANE	EQUILIBRIUM RATIO[b] N-PENTANE
				TEMPERATURE, DEG. F 220						
100.	0.0476	0.0110	6.121E 01	8.810E-01	0.0016	0.0004	2.182E 00	3.028E-02	3.007E 01	9.539E-01
120.	0.1930	0.0505	5.152E 01	8.402E-01	0.0077	0.0017	2.175E 00	3.032E-02	2.508E 01	8.132E-01
140.	0.2955	0.0853	4.451E 01	8.011E-01	0.0137	0.0031	2.169E 00	3.038E-02	2.152E 01	7.143E-01
160.	0.3688	0.1150	3.917E 01	7.611E-01	0.0196	0.0044	2.164E 00	3.045E-02	1.886E 01	6.437E-01
180.	0.4271	0.1422	3.500E 01	7.263E-01	0.0255	0.0058	2.158E 00	3.051E-02	1.678E 01	5.879E-01
200.	0.4720	0.1658	3.167E 01	6.934E-01	0.0312	0.0071	2.153E 00	3.058E-02	1.512E 01	5.450E-01
400.	0.6834	0.3243	1.605E 01	4.749E-01	0.0888	0.0212	2.099E 00	3.125E-02	7.692E 00	3.475E-01
600.	0.7564	0.4085	1.067E 01	3.590E-01	0.1454	0.0365	2.050E 00	3.204E-02	5.202E 00	2.850E-01
800.	0.7873	0.4515	7.875E 00	2.815E-01	0.2012	0.0530	2.005E 00	3.294E-02	3.914E 00	2.662E-01
1000.	0.7987	0.4686	6.157E 00	2.252E-01	0.2543	0.0705	1.966E 00	3.396E-02	3.141E 00	2.700E-01
1200.	0.8003	0.4711	4.988E 00	1.831E-01	0.3052	0.0890	1.936E 00	3.519E-02	2.622E 00	2.875E-01
1400.	0.7973	0.4665	4.154E 00	1.515E-01	0.3579	0.1103	1.914E 00	3.675E-02	2.228E 00	3.157E-01
1600.	0.7899	0.4553	3.521E 00	1.265E-01	0.4113	0.1344	1.901E 00	3.874E-02	1.921E 00	3.569E-01
1800.	0.7727	0.4306	3.013E 00	1.046E-01	0.4715	0.1655	1.927E 00	4.217E-02	1.639E 00	4.300E-01
2000.	0.7409	0.3887	2.574E 00	8.416E-02	0.5671	0.2256	2.020E 00	5.008E-02	1.306E 00	5.985E-01
2078.[e]	0.669	0.310	0.226E 01	0.654E-01	0.669	0.310	0.226E 01	0.654E-01	1.000E 00	1.000E 00
1717.[f]					0.444	0.151				
1157.[g]	0.797	0.466								
				TEMPERATURE, DEG. F 230						
120.	0.0945	0.0227	5.104E 01	7.636E-01	0.0038	0.0009	2.209E 00	3.071E-02	2.477E 01	9.089E-01
140.	0.2128	0.0567	4.415E 01	7.333E-01	0.0100	0.0022	2.203E 00	3.077E-02	2.127E 01	7.952E-01
160.	0.3026	0.0880	3.898E 01	7.065E-01	0.0162	0.0037	2.196E 00	3.083E-02	1.862E 01	7.089E-01
180.	0.3699	0.1155	3.487E 01	6.784E-01	0.0223	0.0050	2.191E 00	3.090E-02	1.659E 01	6.444E-01
200.	0.4180	0.1377	3.155E 01	6.479E-01	0.0280	0.0064	2.186E 00	3.097E-02	1.495E 01	5.987E-01
400.	0.6477	0.2902	1.606E 01	4.486E-01	0.0850	0.0202	2.135E 00	3.168E-02	7.622E 00	3.850E-01
600.	0.7265	0.3713	1.069E 01	3.406E-01	0.1408	0.0352	2.088E 00	3.250E-02	5.158E 00	3.183E-01
800.	0.7620	0.4159	7.902E 00	2.688E-01	0.1966	0.0516	2.044E 00	3.345E-02	3.875E 00	2.962E-01
1000.	0.7749	0.4336	6.177E 00	2.154E-01	0.2496	0.0689	2.007E 00	3.452E-02	3.104E 00	3.000E-01
1200.	0.7772	0.4369	5.003E 00	1.753E-01	0.3020	0.0878	1.979E 00	3.585E-02	2.573E 00	3.192E-01
1400.	0.7744	0.4329	4.159E 00	1.449E-01	0.3555	0.1092	1.960E 00	3.755E-02	2.179E 00	3.500E-01
1600.	0.7658	0.4209	3.511E 00	1.203E-01	0.4114	0.1345	1.957E 00	3.988E-02	1.861E 00	3.980E-01
1800.	0.7492	0.3992	2.992E 00	9.935E-02	0.4791	0.1698	2.000E 00	4.418E-02	1.564E 00	4.814E-01
2000.	0.6757	0.3166	2.427E 00	7.089E-02	0.6124	0.2599	2.183E 00	5.775E-02	1.103E 00	8.365E-01
2011.[e]	0.647	0.290	0.234E 01	0.654E-01	0.647	0.290	0.234E 01	0.654E-01	1.000E 00	1.000E 00
1649.[f]					0.423	0.140				
1160.[g]	0.777	0.437								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N-PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
					TEMPERATURE, DEG. F 240					
140.	0.1221	0.0300	4.364E 01	6.683E-01	0.0058	0.0013	2.240E 00	3.119E-02	2.099E 01	8.831E-01
160.	0.2190	0.0587	3.855E 01	6.439E-01	0.0119	0.0027	2.235E 00	3.126E-02	1.839E 01	7.904E-01
180.	0.2933	0.0845	3.454E 01	6.202E-01	0.0179	0.0040	2.230E 00	3.134E-02	1.639E 01	7.195E-01
200.	0.3514	0.1075	3.131E 01	5.971E-01	0.0238	0.0054	2.224E 00	3.141E-02	1.476E 01	6.644E-01
400.	0.6094	0.2576	1.604E 01	4.226E-01	0.0810	0.0192	2.173E 00	3.214E-02	7.520E 00	4.250E-01
600.	0.6957	0.3370	1.070E 01	3.230E-01	0.1368	0.0340	2.128E 00	3.300E-02	5.087E 00	3.525E-01
800.	0.7393	0.3867	7.923E 00	2.583E-01	0.1933	0.0506	2.084E 00	3.400E-02	3.825E 00	3.231E-01
1000.	0.7523	0.4031	6.191E 00	2.068E-01	0.2460	0.0676	2.051E 00	3.515E-02	3.058E 00	3.285E-01
1200.	0.7546	0.4061	5.011E 00	1.681E-01	0.2989	0.0866	2.024E 00	3.655E-02	2.525E 00	3.500E-01
1400.	0.7527	0.4036	4.155E 00	1.388E-01	0.3540	0.1086	2.011E 00	3.845E-02	2.126E 00	3.829E-01
1600.	0.7443	0.3929	3.492E 00	1.149E-01	0.4129	0.1352	2.018E 00	4.120E-02	1.802E 00	4.356E-01
1800.	0.7166	0.3599	2.938E 00	9.199E-02	0.4899	0.1760	2.101E 00	4.705E-02	1.463E 00	5.556E-01
1941.[e]	0.626	0.271	0.242E 01	0.654E-01	0.626	0.271	0.242E 01	0.654E-01	1.000E 00	1.000E 00
1582.[f]					0.404	0.131				
1159.[g]	0.754	0.406								
					TEMPERATURE, DEG. F 250					
140.	0.0350	0.0080	4.304E 01	6.131E-01	0.0017	0.0004	2.280E 00	3.164E-02	2.064E 01	9.667E-01
160.	0.1379	0.0343	3.807E 01	5.910E-01	0.0076	0.0017	2.274E 00	3.171E-02	1.808E 01	8.687E-01
180.	0.2178	0.0583	3.416E 01	5.700E-01	0.0135	0.0030	2.270E 00	3.179E-02	1.611E 01	7.930E-01
200.	0.2817	0.0802	3.099E 01	5.500E-01	0.0194	0.0044	2.264E 00	3.186E-02	1.451E 01	7.325E-01
400.	0.5635	0.2230	1.595E 01	3.935E-01	0.0761	0.0180	2.215E 00	3.263E-02	7.400E 00	4.725E-01
600.	0.6630	0.3043	1.068E 01	3.054E-01	0.1321	0.0327	2.171E 00	3.354E-02	5.018E 00	3.883E-01
800.	0.7077	0.3499	7.904E 00	2.436E-01	0.1880	0.0489	2.131E 00	3.459E-02	3.765E 00	3.600E-01
1000.	0.7279	0.3730	6.191E 00	1.978E-01	0.2432	0.0667	2.096E 00	3.582E-02	2.993E 00	3.595E-01
1200.	0.7325	0.3785	5.011E 00	1.614E-01	0.2977	0.0861	2.071E 00	3.735E-02	2.461E 00	3.808E-01
1400.	0.7277	0.3727	4.131E 00	1.319E-01	0.3539	0.1086	2.067E 00	3.952E-02	2.056E 00	4.214E-01
1600.	0.7130	0.3558	3.436E 00	1.069E-01	0.4168	0.1371	2.090E 00	4.285E-02	1.711E 00	4.921E-01
1800.	0.6754	0.3163	2.827E 00	8.252E-02	0.5152	0.1911	2.229E 00	5.155E-02	1.311E 00	6.694E-01
1867.[e]	0.602	0.252	0.251E 01	0.654E-01	0.602	0.252	0.251E 01	0.654E-01	1.000E 00	1.000E 00
1514.[f]					0.385	0.122				
1155.[g]	0.731	0.377								
					TEMPERATURE, DEG. F 260					
160.	0.0528	0.0123	3.747E 01	5.416E-01	0.0030	0.0007	2.316E 00	3.217E-02	1.769E 01	9.500E-01
180.	0.1411	0.0352	3.369E 01	5.245E-01	0.0089	0.0020	2.311E 00	3.225E-02	1.577E 01	8.667E-01
200.	0.2119	0.0564	3.060E 01	5.077E-01	0.0149	0.0034	2.306E 00	3.233E-02	1.421E 01	8.000E-01
400.	0.5195	0.1938	1.584E 01	3.683E-01	0.0715	0.0168	2.259E 00	3.316E-02	7.265E 00	5.175E-01
600.	0.6262	0.2714	1.061E 01	2.867E-01	0.1272	0.0314	2.218E 00	3.411E-02	4.922E 00	4.283E-01
800.	0.6763	0.3172	7.869E 00	2.300E-01	0.1831	0.0475	2.180E 00	3.523E-02	3.694E 00	3.962E-01
1000.	0.6958	0.3371	6.151E 00	1.858E-01	0.2376	0.0648	2.150E 00	3.656E-02	2.928E 00	3.990E-01
1200.	0.7027	0.3445	4.977E 00	1.521E-01	0.2936	0.0846	2.130E 00	3.826E-02	2.393E 00	4.208E-01
1400.	0.6941	0.3353	4.079E 00	1.228E-01	0.3521	0.1078	2.138E 00	4.081E-02	1.971E 00	4.721E-01
1600.	0.6720	0.3129	3.335E 00	9.682E-02	0.4251	0.1412	2.177E 00	4.508E-02	1.581E 00	5.706E-01
1787.[e]	0.576	0.232	0.260E 01	0.654E-01	0.576	0.232	0.260E 01	0.654E-01	1.000E 00	1.000E 00
1442.[f]					0.362	0.112				
1147.[g]	0.704	0.346								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
				TEMPERATURE, DEG. F 270						
180.	0.0592	0.0138	3.312E 01	4.812E-01	0.0038	0.0009	2.352E 00	3.270E-02	1.540E 01	9.444E-01
200.	0.1334	0.0331	3.007E 01	4.650E-01	0.0096	0.0021	2.348E 00	3.279E-02	1.390E 01	8.750E-01
400.	0.4751	0.1675	1.569E 01	3.448E-01	0.0668	0.0157	2.307E 00	3.373E-02	7.110E 00	5.625E-01
600.	0.5922	0.2441	1.054E 01	2.708E-01	0.1231	0.0303	2.267E 00	3.475E-02	4.812E 00	4.650E-01
800.	0.6494	0.2917	7.831E 00	2.193E-01	0.1800	0.0465	2.230E 00	3.594E-02	3.609E 00	4.275E-01
1000.	0.6724	0.3134	6.123E 00	1.779E-01	0.2363	0.0644	2.203E 00	3.740E-02	2.845E 00	4.290E-01
1200.	0.6770	0.3179	4.937E 00	1.445E-01	0.2934	0.0845	2.189E 00	3.931E-02	2.307E 00	4.571E-01
1400.	0.6649	0.3062	4.025E 00	1.155E-01	0.3548	0.1089	2.214E 00	4.238E-02	1.874E 00	5.193E-01
1600.	0.6288	0.2736	3.227E 00	8.753E-02	0.4391	0.1483	2.309E 00	4.860E-02	1.432E 00	6.619E-01
1702.[e]	0.550	0.214	0.270E 01	0.654E-01	0.550	0.214	0.270E 01	0.654E-01	1.000E 00	1.000E 00
1377.[f]					0.343	0.104				
1136.[g]	0.675	0.316								
				TEMPERATURE, DEG. F 280						
200.	0.0538	0.0125	2.949E 01	4.265E-01	0.0040	0.0009	2.403E 00	3.341E-02	1.347E 01	9.500E-01
400.	0.4278	0.1425	1.548E 01	3.216E-01	0.0620	0.0145	2.362E 00	3.440E-02	6.902E 00	6.100E-01
600.	0.5550	0.2171	1.042E 01	2.541E-01	0.1188	0.0291	2.323E 00	3.548E-02	4.670E 00	5.050E-01
800.	0.6135	0.2609	7.738E 00	2.051E-01	0.1755	0.0452	2.290E 00	3.676E-02	3.495E 00	4.687E-01
1000.	0.6411	0.2843	6.049E 00	1.672E-01	0.2331	0.0633	2.267E 00	3.837E-02	2.750E 00	4.680E-01
1200.	0.6448	0.2876	4.856E 00	1.350E-01	0.2920	0.0840	2.263E 00	4.057E-02	2.208E 00	5.017E-01
1400.	0.6264	0.2715	3.931E 00	1.062E-01	0.3633	0.1126	2.305E 00	4.452E-02	1.724E 00	5.868E-01
1600.	0.5520	0.2151	3.104E 00	7.538E-02	0.4839	0.1725	2.857E 00	6.350E-02	1.141E 00	8.681E-01
1614.[e]	0.521	0.195	0.280E 01	0.654E-01	0.521	0.195	0.280E 01	0.654E-01	1.000E 00	1.000E 00
1307.[f]					0.323	0.096				
1120.[g]	0.644	0.287								
				TEMPERATURE, DEG. F 290						
400.	0.3721	0.1164	1.518E 01	2.961E-01	0.0558	0.0130	2.420E 00	3.506E-02	6.672E 00	6.650E-01
600.	0.5159	0.1916	1.026E 01	2.375E-01	0.1144	0.0279	2.382E 00	3.624E-02	4.508E 00	5.467E-01
800.	0.5752	0.2314	7.624E 00	1.912E-01	0.1711	0.0439	2.358E 00	3.769E-02	3.362E 00	5.125E-01
1000.	0.6043	0.2535	5.934E 00	1.552E-01	0.2302	0.0624	2.345E 00	3.959E-02	2.625E 00	5.140E-01
1200.	0.6084	0.2567	4.727E 00	1.244E-01	0.2933	0.0845	2.360E 00	4.238E-02	2.074E 00	5.542E-01
1400.	0.5772	0.2328	3.758E 00	9.450E-02	0.3736	0.1171	2.465E 00	4.815E-02	1.545E 00	6.750E-01
1520.[e]	0.492	0.177	0.291E 01	0.654E-01	0.492	0.177	0.291E 01	0.654E-01	1.000E 00	1.000E 00
1236.[f]					0.303	0.088				
1099.[g]	0.609	0.257								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT				BUBBLE POINT				EQUILIBRIUM RATIO[b]	
	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	MOLE F METHANE	WT F METHANE	VOLUME MOLAL[c]	VOLUME SPECIFIC[d]	METHANE	N-PENTANE
				TEMPERATURE, DEG. F 300						
400.	0.3315	0.0993	1.492E 01	2.786E-01	0.0518	0.0120	2.484E 00	3.588E-02	6.397E 00	7.050E-01
600.	0.4766	0.1684	1.006E 01	2.216E-01	0.1104	0.0269	2.447E 00	3.710E-02	4.317E 00	5.883E-01
800.	0.5392	0.2065	7.484E 00	1.786E-01	0.1679	0.0429	2.433E 00	3.878E-02	3.211E 00	5.537E-01
1000.	0.5647	0.2239	5.769E 00	1.426E-01	0.2268	0.0612	2.442E 00	4.110E-02	2.490E 00	5.630E-01
1200.	0.5608	0.2211	4.532E 00	1.114E-01	0.2926	0.0842	2.502E 00	4.490E-02	1.917E 00	6.208E-01
1400.	0.5181	0.1929	3.518E 00	8.167E-02	0.4003	0.1292	2.790E 00	5.615E-02	1.294E 00	8.036E-01
1427.[e]	0.458	0.158	0.304E 01	0.654E-01	0.458	0.158	0.304E 01	0.654E-01	1.000E 00	1.000E 00
1164.[f]					0.281	0.080				
1072.[g]	0.569	0.227								
				TEMPERATURE, DEG. F 310						
400.	0.2719	0.0767	1.449E 01	2.546E-01	0.0451	0.0104	2.556E 00	3.671E-02	6.032E 00	7.625E-01
600.	0.4357	0.1465	9.831E 00	2.061E-01	0.1067	0.0259	2.520E 00	3.808E-02	4.085E 00	6.317E-01
800.	0.5010	0.1825	7.308E 00	1.659E-01	0.1649	0.0421	2.520E 00	4.006E-02	3.039E 00	5.975E-01
1000.	0.5253	0.1974	5.567E 00	1.304E-01	0.2281	0.0616	2.549E 00	4.295E-02	2.303E 00	6.150E-01
1200.	0.5177	0.1927	4.288E 00	9.948E-02	0.3060	0.0893	2.667E 00	4.850E-02	1.692E 00	6.950E-01
1334.[e]	0.423	0.140	0.317E 01	0.654E-01	0.423	0.140	0.317E 01	0.654E-01	1.000E 00	1.000E 00
1090.[f]					0.259	0.072				
1040.[g]	0.525	0.197								
				TEMPERATURE, DEG. F 320						
400.	0.2162	0.0578	1.403E 01	2.337E-01	0.0383	0.0088	2.634E 00	3.763E-02	5.642E 00	8.150E-01
600.	0.3892	0.1241	9.528E 00	1.894E-01	0.1017	0.0246	2.605E 00	3.921E-02	3.825E 00	6.800E-01
800.	0.4577	0.1580	7.076E 00	1.523E-01	0.1609	0.0409	2.623E 00	4.155E-02	2.845E 00	6.462E-01
1000.	0.4718	0.1657	5.270E 00	1.154E-01	0.2266	0.0612	2.703E 00	4.548E-02	2.082E 00	6.830E-01
1200.	0.4366	0.1470	3.861E 00	8.101E-02	0.3352	0.1008	2.929E 00	5.490E-02	1.302E 00	8.475E-01
1233.[e]	0.382	0.121	0.332E 01	0.654E-01	0.382	0.121	0.332E 01	0.654E-01	1.000E 00	1.000E 00
1015.[f]					0.235	0.064				
997.[g]	0.472	0.166								
				TEMPERATURE, DEG. F 330						
400.	0.1534	0.0387	1.345E 01	2.116E-01	0.0297	0.0068	2.721E 00	3.861E-02	5.167E 00	8.725E-01
600.	0.3358	0.1010	9.150E 00	1.716E-01	0.0953	0.0229	2.704E 00	4.048E-02	3.525E 00	7.342E-01
800.	0.4056	0.1317	6.765E 00	1.370E-01	0.1554	0.0393	2.747E 00	4.330E-02	2.610E 00	7.037E-01
1000.	0.4205	0.1389	4.930E 00	1.015E-01	0.2309	0.0626	2.880E 00	4.866E-02	1.821E 00	7.535E-01
1133.[e]	0.341	0.103	0.347E 01	0.654E-01	0.341	0.103	0.347E 01	0.654E-01	1.000E 00	1.000E 00
942.[f]					0.207	0.055				
949.[g]	0.421	0.139								

See footnotes at the end of this table.

TABLE 3.4 PROPERTIES OF THE COEXISTING PHASES IN THE METHANE–N–PENTANE SYSTEM, ENGINEERING UNITS – CONTINUED

PRESSURE[a] PSIA	DEW POINT MOLE F METHANE	DEW POINT WT F METHANE	DEW POINT VOLUME MOLAL[c]	DEW POINT VOLUME SPECIFIC[d]	BUBBLE POINT MOLE F METHANE	BUBBLE POINT WT F METHANE	BUBBLE POINT VOLUME MOLAL[c]	BUBBLE POINT VOLUME SPECIFIC[d]	EQUILIBRIUM RATIO[b] METHANE	EQUILIBRIUM RATIO[b] N-PENTANE
				TEMPERATURE, DEG. F 340						
400.	0.0968	0.0233	1.286E 01	1.928E-01	0.0209	0.0047	2.812E 00	3.962E-02	4.625E 00	9.225E-01
600.	0.2793	0.0793	8.723E 00	1.544E-01	0.0877	0.0209	2.817E 00	4.190E-02	3.185E 00	7.900E-01
800.	0.3548	0.1090	6.417E 00	1.228E-01	0.1511	0.0381	2.888E 00	4.536E-02	2.349E 00	7.600E-01
1000.	0.3385	0.1021	4.398E 00	8.273E-02	0.2533	0.0701	3.364E 00	5.806E-02	1.336E 00	8.860E-01
1030.[e]	0.295	0.085	0.364E 01	0.654E-01	0.295	0.085	0.364E 01	0.654E-01	1.000E 00	1.000E 00
868.[f]					0.178	0.046				
889.[g]	0.362	0.112								
				TEMPERATURE, DEG. F 350						
400.	0.059	0.014	0.123E 02	0.179E-00	0.015	0.003	0.291E 01	0.408E-01	4.01E 00	9.55E-01
600.	0.228	0.062	0.826E 01	0.139E-00	0.081	0.019	0.294E 01	0.435E-01	2.80E 00	8.40E-01
800.	0.296	0.085	0.599E 01	0.108E-00	0.151	0.038	0.306E 01	0.480E-01	1.96E 00	8.29E-01
922.[e]	0.244	0.067	0.382E 01	0.654E-01	0.244	0.067	0.382E 01	0.654E-01	1.00E 00	1.00E 00
792.[f]					0.151	0.038				
822.[g]	0.292	0.084								
				TEMPERATURE, DEG. F 360						
400.	0.007	0.002	0.117E 02	0.163E-00	0.002	0.000	0.302E 01	0.420E-01	3.30E 00	9.95E-01
600.	0.184	0.048	0.779E 01	0.126E-00	0.077	0.018	0.306E 01	0.451E-01	2.40E 00	8.83E-01
800.	0.205	0.054	0.533E 01	0.879E-01	0.163	0.042	0.326E 01	0.518E-01	1.26E 00	9.50E-01
814.[e]	0.191	0.050	0.402E 01	0.654E-01	0.191	0.050	0.402E 01	0.654E-01	1.00E 00	1.00E 00
715.[f]					0.115	0.028				
742.[g]	0.220	0.059								
				TEMPERATURE, DEG. F 370						
600.	0.126	0.031	0.717E 01	0.110E-00	0.065	0.015	0.322E 01	0.470E-01	1.93E 00	9.35E-01
694.[e]	0.122	0.030	0.427E 01	0.654E-01	0.122	0.030	0.427E 01	0.654E-01	1.00E 00	1.00E 00
639.[f]					0.076	0.018				
657.[g]	0.144	0.036								

[a] (psia)(6894.757)= N/m^2

[b] Molal equilibrium ratio, $K_k = y_k / x_k$

[c] Volume expressed in ft^3/lb-mol

[d] Volume expressed in ft^3/lb

[e] Estimated critical state

[f] Estimated maxcondenbar

[g] Estimated maxcondentherm

TABLE 3.5. *Unique states for the methane-n-pentane system, engineering units*

Methane		Critical				Maxcondenbar		Maxcondentherm	
Mole fraction	Weight fraction	Temperature	Pressure [a]	Volume		Temperature	Pressure [a]	Temperature	Pressure [a]
				Molal [b]	Specific [c]				
		°F	*psia*			°F	*psia*	°F	*psia*
0.0	0.0	[d] 385.41	487.3	4.72	0.0654	385.41	487.3	385.41	487.3
.333	.1	332.1	1115	3.50	.0654	275.5	1344	344.2	862
.529	.2	277.8	1635	2.78	.0654	181.0	1962	308.9	1042
.658	.3	225.4	2043	2.30	.0654	131.5	2240	275.7	1127
.750	.4	172.9	2298	1.95	.0648	99.8	2387	242.3	1159
.818	.5	101.3	2447	1.59	.0605	[e] 70.7	2462	209.0	1152
.871	.6	[e] 35.4	2486	.....	.....	35.9	2486	176.3	1114
.913	.7	−4.2	2454	.....	.....	−4.2	2454	141.2	1047
.947	.8	−41.5	2291	.....	.....	−41.5	2291	[e] 97.8	947
.976	.9	−79.5	1902	.....	.....	−79.5	1902	43.1	818
1.0	1.0	[d] −116.54	669.7	1.59	.0990	−116.54	669.7	−116.54	669.7
.1	.024	373.4	650	4.35	.0654	364.5	678	375.1	608
.2	.053	357.8	838	3.98	.0654	332.1	927	362.3	723
.3	.087	339.2	1039	3.62	.0654	291.0	1227	349.2	829
.4	.129	316.0	1274	3.25	.0654	242.8	1564	333.5	929
.5	.182	287.0	1545	2.88	.0654	193.6	1884	314.9	1018
.6	.250	250.7	1860	2.52	.0654	151.8	2129	292.4	1093
.7	.342	203.7	2168	2.15	.0653	117.6	2309	261.7	1146
.8	.471	129.8	2410	1.70	.0624	[e] 79.5	2448	218.8	1157
.9	.667	8.7	2475	.....	.....	8.7	2475	152.6	1073
Estimated uncertainty [f]		1.0	1.0	3.0		2.0	4.0	2.0	3.0

[a] (Psia) $(6.894757 \times 10^3) = N/m^2$.
[b] Volume expressed in cu ft/lb-mol.
[c] Volume expressed in cu ft/lb.
[d] API 44 [16].
[e] Values at this and lower temperatures extrapolated.
[f] Estimated uncertainty expressed in percent.

TABLE 3.6. *Agreement of interpolated and experimental data for the methane-n-pentane system, engineering units*

Source	Number of points	Deviation		
		Average [a]	Fraction [b]	Standard [c]
Composition [d]				
Taylor [36]	14	0.0021	0.0042	0.0116
Dourson [37]	4	.0078	.0198	.0164
Sage [38]	32	.0007	.0035	.0037
Pressure [e]				
Sage [38]	34	−0.7	0.0054	4.9
Sage [35]	9	69.9	.0395	80.8

[a] Average deviation defined by $\left[\sum_1^n (G_{k\,exp} - G_{k\,sm})\right]/N$.
[b] Fractional deviation defined by $\left\{\sum_1^N \left[(G_{k\,exp} - G_{sm})/G_{k\,exp}\right]\right\}/N$.
[c] Standard deviation defined by $\left\{\left[\sum_1^N (G_{k\,exp} - C_{k\,sm})^2\right]/(N-1)\right\}^{1/2}$ where G = either composition or pressure.
[d] Composition in weight methane.
[e] Pressure in psia.

TABLE 3.7. *Accuracy of experimental background for the methane-n-pentane system*

Quantity	Units	Taylor [36]	Dourson [37]	Sage [35]	Sage [38]
Sample purity					
Methane	Mole	0.990	0.997	0.997	0.997
n-Pentane	fraction	.995	.995	.992	.992
Composition					
Volumetric [a]	Atm				0.2
Phase measurements	Weight fraction	0.01–0.02	0.005		.005
Volumetric behavior	Percent	0.3–3.0		0.4	0.5
Unique states					
Temperature	K				1.0
Pressure	Atm				0.8
Volume	Percent				5

[a] Phase boundaries determined from first derivative of volume versus pressure. All error assumed to be in pressure.

4. References

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