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Abstract

The Helmholtz function for pure isobutane from a recent correlation has been converted to a dimensionless form and a pressure-enthalpy chart based on this function has been generated by computer. A Helmholtz function for mixtures of isobutane and isopentane has been formed based upon the dimensionless isobutane Helmholtz function as the reference fluid by means of an extended corresponding-states principle. Scarce literature data for saturation properties of isopentane, and new data for its vapor pressure and for the critical line of the mixture were used. The accuracy of the surface was checked by comparing with literature enthalpy data and with new VLE data for the mixture. Tables of thermodynamic properties have been generated from this Helmholtz function for the 0.1 mole fraction isopentane-in-isobutane mixture in the single-phase region and on the dew- and bubble-point curves, together with properties of the coexisting phase. A pressure-enthalpy chart for this mixture has also been generated.

EXB

TABLE OF CONTENTS

Introduction

Interest has been growing for several years in the use of isobutane and isobutane-isopentane mixtures as working fluids in binary geothermal power cycles. While these substances appear to have desirable characteristics for such uses, including the possibility of "tuning" the properties of the working fluid to the existing external conditions by adjusting the composition of the mixture, there has been in the past a scarcity of experimental data available and no good basis for predicting with any accuracy the properties needed by the engineer for the efficient design of these power cycles[1]. The Division of Geothermal and Hydropower Technology of the Department of Energy has supported for several years a program of research both to improve the available experimental data base and to correlate these data for the production of tables and charts of use to the designer of power cycles.

Preceding the work reported here, scientists at NBS prepared a new correlation of the thermodynamic properties of isobutane, based on existing data and new data taken at NBS[2]. Also, a subregion around the critical point was separately described by means of a so-called scaled equation[3]. For isopentane, only scarce data were available. The data base available for the mixtures was limited to some data on the location of the critical line obtained at NBS, and a report on enthalpy-of-mixing data. The program TRAPP, developed at NBS[4], allowed prediction of single-phase thermodynamic properties of the mixture of isobutane and isopentane by means of a generalized principle of corresponding states. A serious drawback was, however, that the reference function used in this program was methane. Therefore, the TRAPP predictions of the properties of isobutane, the principal component in the mixture of interest here, were substantially less accurate than the thermodynamic surface that we already had developed for this fluid. We therefore decided to follow the principle embodied in the program TRAPP, but to use our own thermodynamic surface for isobutane as the reference.

The use of the principal component of the mixture as a reference should lead to a significant increase in the reliability of the property predictions.

1. DIMENSIONLESS REFERENCE FUNCTION FOR ISOBUTANE

The global Helmholtz function representing the thermodynamic surface for pure isobutane has been described in two earlier publications[2]. For use as the reference function for mixtures this Helmholtz function was converted to a dimensionless form in the following way:

Definitions. Quantities in the reduced dimensionless form will be represented with a "bar" above the symbol. The reduction parameters will be represented as symbols with an asterisk ("*") or double asterisk as superscripts. The primary reduction parameters are:

$$\begin{aligned} &\text{Temperature } T^* = 407.84 \text{ K} \\ &\text{Density } \rho^* = 3879.6 \text{ mol/m}^3 \\ &\text{Pressure } P^* = 3.6290 \text{ MPa} \end{aligned} \qquad (1a)$$

These reference constants are the best estimates of the critical point of isobutane[2,3].

Physical constants[5]:

$$\begin{aligned} &\text{Molecular weight } M = 0.0581243 \text{ kg/mol} \\ &\text{Gas constant } R = 8.31441 \text{ J/(mol K)} \end{aligned} \qquad (1b)$$

Derived reduction parameters:

$$\begin{aligned} A^{**} &= P^*/\rho^* = 935.41 \text{ J/mol} \\ S^{**} &= P^*/(\rho^* T^*) = 2.2936 \text{ J/(mol K)} \\ a^{**} &= (P^*/(\rho^* M))^{1/2} = 126.86 \text{ m/s} \end{aligned} \qquad (2)$$

The dimensionless form of the thermodynamic properties will be obtained by:

Temperature	$\overline{T} = T/T^*$
Pressure	$\overline{P} = P/P^*$
Density	$\overline{\rho} = \rho/\rho^*$
Volume	$\overline{V} = V \cdot \rho^* = 1/\overline{\rho}$
Helmholtz function	$\overline{A} = A/A^{**}$
Gibbs function	$\overline{G} = G/A^{**}$
Internal Energy	$\overline{U} = U/A^{**}$
Enthalpy	$\overline{H} = H/A^{**}$
Entropy	$\overline{S} = S/S^{**}$
Heat capacities	$\overline{C}_v = C_v/S^{**}$
	and $\overline{C}_p = C_p/S^{**}$
Speed of Sound	$\overline{a} = a/a^{**}$

(3)

Note: All extensive thermodynamic properties are taken per mole.

We will make use of the following thermodynamic relations between the thermodynamic properties.

$$
\begin{aligned}
\bar{V} &= \bar{\rho}^{-1} \\
\bar{P} &= \bar{\rho}^{2}\,(\partial\bar{A}/\partial\bar{\rho})_{\bar{T}} \\
(\partial\bar{P}/\partial\bar{\rho})_{\bar{T}} &= 2\,\bar{P}/\bar{\rho} + \bar{\rho}^{2}(\partial^{2}\bar{A}/\partial\bar{\rho}^{2})_{\bar{T}} \\
(\partial\bar{P}/\partial\bar{T})_{\bar{\rho}} &= \bar{\rho}^{2}(\partial^{2}\bar{A}/\partial\bar{\rho}\partial\bar{T}) \\
\bar{S} &= -\,(\partial\bar{A}/\partial\bar{T})_{\bar{\rho}} \\
\bar{U} &= \bar{A} + \bar{T}\,\bar{S} \\
\bar{H} &= \bar{U} + \bar{P}/\bar{\rho} \\
\bar{G} &= \bar{A} + \bar{P}/\bar{\rho} \\
\bar{C}_{v} &= -\,\bar{T}(\partial^{2}\bar{A}/\partial\bar{T}^{2})_{\bar{\rho}} \\
\bar{C}_{p} &= \bar{C}_{v} + (\bar{T}/\bar{\rho}^{2})\,(\partial\bar{P}/\partial\bar{T})^{2}_{\bar{\rho}}\,/(\partial\bar{P}/\partial\bar{\rho})_{\bar{T}} \\
\bar{a} &= [(\bar{C}_{p}/\bar{C}_{v})(\partial\bar{P}/\partial\bar{\rho})_{\bar{T}}]^{1/2}
\end{aligned}
\qquad (4)
$$

The Fundamental Equation. The Helmholtz energy function as described in ref. (2) can, with a little re-arranging, be written as:

$$A(T,V) = A_0(T) + A_1(T,V) + A_2(T,V) + A_3\,(T,V), \qquad (5)$$

where the A_{base} of ref. (2) has been separated into two functions: A_1 containing those parts of A_{base} depending on the "pseudo" second virial B, and A_2 those parts involving the "excluded volume" b. Dividing this equation by the reduction parameter A^{**} and defining $\bar{\rho} = \bar{V}^{-1}$ we have the fundamental equation in dimensionless form:

$$\bar{A}(\bar{T},\bar{V}) = \bar{A}_0(\bar{T}) + \bar{A}_1(\bar{T},\bar{V}) + \bar{A}_2(\bar{T},\bar{V}) + \bar{A}_3(\bar{T},\bar{V}), \qquad (6)$$

where now the form of each of the component parts of eq (6) is

$$\bar{A}_0 = (A_{00} + A_{01}\bar{T})\,\ell n\,\bar{T} + \sum_{i=2}^{8} A_{01}\,\bar{T}^{\,i-4} + A_{09}\,\bar{T}\,\ell n(e^{x} - 1)$$

$$\text{with } x = \frac{x_0}{\bar{T}} \qquad (7)$$

$$\bar{A}_1 = \bar{\rho}\,\bar{T}\left[A_{10} + \frac{A_{11}}{\bar{T}} + \frac{A_{12}}{\bar{T}^3} + \frac{A_{13}}{\bar{T}^5} + \frac{A_{14}}{\bar{T}^{10}}\right] \tag{8}$$

$$\bar{A}_2 = A_{20}\,\bar{T}\left[\ell n\left(\frac{\bar{\rho}}{1-y}\right) + \frac{3}{2(1-y)^2} - 4y\right] \tag{9}$$

$$\text{with } y = \bar{\rho}\left[y_0 + y_1\,\ell n\,\bar{T} + \frac{y_2}{\bar{T}^4} + \frac{y_3}{\bar{T}^8}\right]$$

$$\bar{A}_3 = \sum_{i=1}\sum_{j=1} B_{ij}\, z^{i+1}\left(\frac{1}{\bar{T}}\right)^j \tag{10}$$

$$\text{with } z = 1 - e^{-z_0\bar{\rho}}\,.$$

Now the remaining task is to evaluate the various coefficients of these equations in terms of the coefficients of the original dimensioned Helmholtz function of ref. (2). To do so, the following auxillary quantities will be used:

reduced gas constant $\quad R^{**} = R/S^{**} = 3.6250$

$$\bar{T}_c = T_c/T^*$$

We calculate the coefficients of the dimensionless Helmholtz function in terms of the coefficients of the dimensioned equation[2] (N_1-N_q, B_i, b_i, C_{ij}) as follows

Coefficients for $\overline{A}_o$:

$$x_0 = N_9/T^*$$

$$A_{00} = \frac{R^{**}N_3}{T^*} \qquad A_{06} = -\frac{R^{**}N_5T^*}{2}$$

$$A_{01} = -R^{**}(N_4-1) \qquad A_{07} = -\frac{R^{**}N_6T^{*2}}{6} \qquad (11)$$

$$A_{02} = -\frac{R^{**}N_1}{6T^{*3}} \qquad A_{08} = -\frac{R^{**}N_7T^{*3}}{12}$$

$$A_{03} = -\frac{R^{**}N_2}{2T^{*2}} \qquad A_{09} = R^{**}N_8$$

The coefficients A_{04} and A_{05} are to be determined from the condition that both $\overline{A}$ and $\overline{S}$ should be zero in the reference state.

Coefficients for $\bar{A}_1$

$$A_{10} = R^{**}\rho^{*}B_0 \qquad A_{13} = R^{**}\rho^{*}\bar{T}_c^{5}B_5$$

$$A_{11} = R^{**}\rho^{*}\bar{T}_c B_1 \qquad A_{14} = R^{**}\rho^{*}\bar{T}_c^{10}B_{10}$$

$$A_{12} = R^{**}\rho^{*}\bar{T}_c^{3}B_3 \tag{12}$$

Coefficients for $\bar{A}_2$

$$A_{20} = R^{**}$$

$$y_0 = \frac{\rho^*}{4}(b_0 + b_1 \ln \bar{T}_c), \qquad y_2 = \frac{\rho^*}{4} b_4 \bar{T}_c^{4} \tag{13}$$

$$y_1 = \frac{\rho^*}{4} b_L \qquad y_3 = \frac{\rho^*}{4} b_8 \bar{T}_c^{8}$$

Coefficients for $\bar{A}_3$

$$Z_0 = \alpha\rho^*$$

$$B_{ij} = \frac{\rho^*}{p^*} \frac{C_{ij}\bar{T}_c^{j}}{\alpha(i+1)} \tag{14}$$

The value determined for each of these coefficients is listed in Table I. The coefficients A_{04} and A_{05} have been determined so that $\bar{A}$ and $\bar{S}$ are zero at the critical point given in eq (1). The new dimensionless Helmholtz function has now been completely determined.

Evaluation of thermodynamic properties

By means of eq (14) and the relations shown in eq (4) the other thermodynamic properties may now be evaluated. The evaluation of the pressure is shown here as typical of the procedures involved.

Pressure

$$\overline{P} = \overline{\rho}^{\,2} \left[(\partial \overline{A}/\partial \overline{\rho})\right] = \overline{\rho}^{\,2}\, \overline{\Pi}$$

where $\overline{\Pi} = \overline{\Pi}_0 + \overline{\Pi}_1 + \overline{\Pi}_2 + \overline{\Pi}_3$

$$\overline{\Pi}_0 = 0$$

$$\overline{\Pi}_1 = \frac{\overline{A}_1}{\overline{\rho}} \qquad (15)$$

$$\overline{\Pi}_2 = \frac{A_{20}\,\overline{T}}{\overline{\rho}} \left[1/(1 - y) + 3y/(1 - y)^3 - 4y\right]$$

$$\overline{\Pi}_3 = z_0(1 - z) \sum_{i=1} \sum_{j=1} B_{ij}\, (i + 1)\, z^i\, (1/\overline{T})^j$$

The Helmholtz function for pure isobutane excludes a small region about the critical point inside of which the values predicted for the thermodynamic functions are less accurate. This region transforms, in the dimensionless units, to an excluded region defined by $0.7 < \overline{\rho} < 1.3$ and $0.985 < \overline{T} < 1.015$. Within this region a separate equation using scaling theory has been formulated[3].

2. THE THERMODYNAMIC SURFACE FOR ISOPENTANE.

A Helmholtz function for pure isopentane was next constructed from the Helmholtz function for pure isobutane using extensions to "simple" corresponding states[4,6,7,8]. In the following description of this method we will use the subscript 4 to refer to isobutane, and 5 to isopentane. The superscript c will be used to refer to a critical point value.

Let us first define the following quantities:

$$f_0 = \overline{T}_5^c / \overline{T}_4^c,$$
$$h_0 = \overline{V}_5^c / \overline{V}_4^c, \qquad (16)$$
$$q_0 = \overline{P}_5^c / \overline{P}_4^c.$$

The properties of isopentane used in this definition are made dimensionless by means of the same reference constants as those of isobutane (see eq (1)). The critical constants of isopentane we have used are listed in Table 2a. They were determined at NBS within the framework of another contract[13].

The principle of corresponding states postulates that, for all values of V and T,

$$Z_5(\overline{V}_5,\overline{T}_5) = Z_4\ (\overline{V}_4 = \overline{V}_5/h_0,\ \overline{T}_4 = \overline{T}_5/f_0) \qquad (17)$$

$$\text{and}\quad \overline{A}^{cf}{}_5(\overline{V}_5,\overline{T}_5) = f_0\, \overline{A}^{cf}{}_4(\overline{V}_4 = \overline{V}_5/h_0,\ \overline{T}_4 = \overline{T}_5/f_0) - R^{**}\overline{T}_5\, \ell n(h_0),$$

where Z is the compressibility factor PV/RT (= $\overline{P}\,\overline{V}/R^{**}\overline{T}$), and $\overline{A}^{cf}$ is the configurational portion of the Helmholtz function, $\overline{A}^{cf} = \overline{A} - \overline{A}_0$. These relations imply that $f_0 = h_0\, q_0$[6].

Since no two substances obey the principle of corresponding states exactly, Rowlinson et al. [6] and Leland et al. [7,8] proposed to generalize the principle through the use of two functions, $\theta(V,T)$ and $\phi(V,T)$ to be defined, in the dimensionless system we are using here, through:

$$f = (\overline{T}_5^c/\overline{T}_4^c)\ \theta(\overline{V}_4,\overline{T}_4) \qquad (18)$$

$$\text{and}\quad q = (\overline{P}_5^c/\ \overline{P}_4^c)\ \theta(\overline{V}_4,\overline{T}_4)\ /\ \phi(\overline{V}_4,\overline{T}_4),$$

so that h will be given by

$$h = f/q = (\overline{T}_5^c/\ \overline{T}_4^c)(\overline{P}_4^c/\ \overline{P}_5^c)\ \phi(\overline{V}_4,\overline{T}_4). \qquad (18a)$$

These functions Θ and Φ are expected to be slowly varying functions of $\overline{V}_4$ and $\overline{T}_4$; to not be greatly different from unity since Z_5^c / Z_4^c is close to unity; and to be constructed such that eq (17) will be satisfied for the real fluids and with this new f, q and h substituted for the f_0, q_0 and h_0.

$$Z_5\ (\overline{V}_5, \overline{T}_5) = Z_4(\overline{V}_4 = \overline{V}_5/h, \overline{T}_4 = \overline{T}_5/f),$$

$$\overline{A}_5^{cf}\ (\overline{V}_5, \overline{T}_5) = f\overline{A}_4^{cf}\ (\overline{V}_4 = \overline{V}_5/h, \overline{T}_4 = \overline{T}_5/f) - R^{**}\overline{T}_5\ \ell n(h). \tag{18b}$$

With h defined in this way, the real $\overline{V}_5^c$ no longer appears in the formulation. In its place appears a constructed $\overline{V}_5^c$ given by $h\overline{V}_4^c$, which, depending on the choice of the function Φ, may or may not have the same value as the real one. We shall use the symbol $\overline{V}_5^{c'}$ for this constructed quantity. This quantity was chosen as the one to be constructed since V_5^c is less well known than P_5^c or T_5^c.

Our choice for the functions Θ and Φ was made through the following steps:

1. The decision was made to map the vapor pressures and coexisting densities of the pure isopentane onto the pure isobutane surface. There have been vapor pressure measurements taken at this laboratory as a part of this project covering the range of 97°C to 181°C[13]. Measurements of the coexisting liquid and vapor densities have been made many years ago[9], over the range of 0°C to 180°C, but it was felt that the higher temperature values might be less reliable. This method requires a temperature region where both vapor pressure and coexisting densities are available, so our efforts were concentrated in the range of overlap, $80°C \leq T < 140°C$. A preliminary fit of a simple empirical function to the vapor pressure data was made to make interpolation possible in order to obtain vapor pressures at the same temperatures as the coexisting density data.

2. A numerical value for Θ and Φ at each chosen temperature point was found through the following iterative process:

a. Assume a starting value for Θ for instance, $\Theta = 1$. Call it Θ_0.

b. $\bar{T}_4$ may now be calculated from the input temperature from $\bar{T}_4 = \bar{T}_5 / (f_0 \cdot \Theta_0)$.

c. From the reference Helmholtz function for pure isobutane calculate the corresponding vapor pressure $\bar{P}_{4S}(\bar{T}_4)$.

d. From the isobutane reference function and this $\bar{T}_4$ and $\bar{P}_{4S}$ find the saturation density $\bar{\rho}_4$.

e. Obtain a value for Φ from $\Phi = \bar{\rho}_4/(\bar{\rho}_5\ h_0)$.

f. Obtain a new value for Θ from the input pressure through $\Theta_1 = \Phi\ \bar{P}_{5S} / \bar{P}_{4S}$, where the $\bar{P}_{5S}$ is obtained from the empirical function obtained in step 1.

g. Increment the value for Θ_i and repeat steps a through f until a Θ_i is found such that $\Theta_{i+1} = \Theta_i$. We now have a numerical value for Θ and Φ at the chosen point.

3. With this set of numerical values for Θ and Φ at each of the chosen points, empirical functions for Θ and Φ were constructed to represent them as functions of the density and temperature with the additional imposed restraint that the value never differs greatly from unity over the desired range of temperatures and densities of the global surface. The value at the critical point could have been fixed, but allowing this value to float made easier the task of representing the Θ and Φ at lower temperatures. In fitting to the chosen empirical functions for Θ and Φ, the values at the critical point were so close to unity that fixing them at unity caused no significant degradation.

The representations for $\Theta(\bar{V}_4, \bar{T}_4)$ and $\Phi(\bar{V}_4, \bar{T}_4)$ used are

$$\Theta = a_1 + a_2\ (\bar{\rho}_4 - 1) + a_3\ (\bar{T}_4 - 1),$$

$$\Phi = b_1 + b_2\ (\bar{\rho}_4 - 1) + b_3\ (\bar{T}_4 - 1). \qquad (19)$$

The values of the constants a_1 through b_3 are given in Table 2b.

Also required for the complete description of the thermodynamic surface of isopentane is the ideal-gas Helmholtz function for isopentane. For this we interpolate in the table of ideal gas thermodynamic functions of isopentane compiled by Scott[10].

3. GENERALIZED CORRESPONDING STATES FOR THE MIXTURE.

The principles of corresponding states can be extended to include mixtures through an approximation usually referred to as the "one-fluid" model. In this model the assumption is made that the configurational Helmholtz function for the mixture (less the ideal-mixing term) can be represented as the Helmholtz function for a single equivalent substance, and the finding of the parameters describing this substance becomes our task.

For a mixture of molar fraction x of isopentane (and 1-x of isobutane), molar volume V_x and temperature T_x, we obtain the configurational Helmholtz function from that of isobutane in the same manner as for pure isopentane by the relations

$$Z_x\ (\overline{V}_x,\overline{T}_x) = Z_4\ (\overline{V}_4 = \overline{V}_x/h_x,\ \overline{T}_4 = \overline{T}_x/f_x)$$

and (20)

$$\overline{A}_x^{cf}\ (\overline{V}_x,\overline{T}_x) = f_x\ \overline{A}_x^{cf}\ (\overline{V}_4 = \overline{V}_x/h_x,\ \overline{T}_4 = \overline{T}_x/f_x) - R^{**}\overline{T}_x\ \ell n(h_x)$$

where h_x, f_x are defined by

$$h_x = (\overline{V}_x^c/\overline{V}_4^c)\ [1 + x\ \{\Phi\ (\overline{V}_4,\overline{T}_4) - 1\}]$$

and

$$f_x = (\overline{T}_x^c/\overline{T}_4^c)[1 + x\ \{\Theta(\overline{V}_4,\overline{T}_4) - 1\}] \qquad (21)$$

Equations (21) insure that for x=0 (pure isobutane) f_x and h_x will be unity; and for x=1 (pure isopentane), f_x and h_x will reduce to equations (18).

Left to be defined are the constants $\bar{V}_x^c$ and $\bar{T}_x^c$ of eqn. (21). We will refer to them as "pseudocritical" constants, since they will define the shape the line of critical points would have if the composition of the liquid and vapor phases were constrained to be the same; that is, the locus of $(\partial P/\partial V)_{Tx} = 0$, $(\partial^2 P/\partial V^2)_{Tx} = 0$ for the homogeneous mixture. In reality, the mixture separates because of material instability prior to reaching the "pseudocritical" line; the real critical line will be determined by a method to be described later.

Many different prescriptions for obtaining $\bar{V}_x^c$ and $\bar{T}_x^c$ have been proposed, referred to as mixing rules. The one we chose is the "van der Waals" type rule:

$$\bar{V}_x^c = (1-x)^2 \bar{V}_4^c + 2x(1-x)\bar{V}_{45}^c + x^2 \bar{V}_5^{c'},$$

$$\bar{T}_x^c = (1-x)^2 \bar{T}_4^c + 2x(1-x) \bar{T}_{45}^c + x^2\bar{T}_5^c, \tag{22}$$

where the terms $\bar{V}_{45}^c$ and $\bar{T}_{45}^c$ are defined by the "combining rules":

$$\bar{V}_{45}^c = k\,[0.5(\bar{V}_4^c)^{1/3} + 0.5(\bar{V}_5^{c'})^{1/3}]^3,$$

$$\bar{T}_{45}^c = \ell\,[\bar{T}_4^c\,\bar{T}_5^c]^{1/2}\,. \tag{23}$$

These definitions allow two more adjustable parameters, k and ℓ, which change the shape of the pseudo-critical line (and also the real critical line) and which we can use to improve agreement with any mixture data that might be available. As a part of another project, measurements have been made at this laboratory of the critical temperature, pressure and volume of pure isobutane, pure isopentane and of mixtures at three

compositions[13]. The critical temperature of isobutane predicted by the global reference function is about 2°C higher than the physical value. This was done on purpose: relaxing the tightness of the fit to the immediate vicinity of the critical point greatly enhances the quality of the fit in the supercritical region. The corresponding-states principle used here induces a similar offset at the pure-isopentane critical point. We chose the values for k and ℓ such that this offset also occurs at the measured mixture critical points. The parameters k and ℓ are found to be close to unity, and are listed in table 2c.

The ideal-gas portion of the total Helmholtz function is computed as a linear combination of the ideal gas functions for the pure substances and ideal mixing term:

$$\bar{A}_{x0}(\bar{T}_4) = (1-x)\bar{A}_{40}(\bar{T}_4) + x\bar{A}_{50}(\bar{T}_4) + R^{**}\bar{T}_4\,[x\,\ell n\,(x) + (1-x)\,\ell n\,(1-x)] \qquad (24)$$

The Helmholtz function for the mixture is now complete. All thermodynamic properties obtainable through combinations of derivatives with respect to V or T may still be calculated in this way. One more property, the chemical potential, necessary for the determination of coexisting phases and the real critical line, remains to be determined. It differs from the other properties described in that it requires derivatives of the Helmholtz function with respect to x.

Calculation of the chemical potentials

The chemical potentials, defined as

$$\bar{\mu}_4\,(\bar{P}, \bar{T}, x) = \bar{G} - x(\partial\bar{G}/\partial x)_{P,T}$$

$$\bar{\mu}_5\,(\bar{P}, \bar{T}, x) = \bar{G} + (1 - x)\,(\partial\bar{G}/\partial x)_{P,T} \qquad (25)$$

are calculated here using numerical derivatives $\Delta\bar{G}/\Delta x$. Since it can be shown that $(\partial G/\partial x)_{P,T} \equiv (\partial A/\partial x)_{V,T}$[11], we chose the latter form for the derivative as a convenience, since the natural independent variables of the reference function are V and T. In terms of derivatives of the Helmholtz function, the expressions for the chemical potential of the two components are:

$$\bar{\mu}_4 = \bar{A}(\bar{V},\bar{T},x) + \bar{p}\,\bar{V} - x(\Delta\bar{A}/\Delta x)_{\bar{V},\bar{T}} \tag{26}$$

$$\text{and } \bar{\mu}_5 = \bar{A}(\bar{V},\bar{T},x) + \bar{p}\,\bar{V} + (1 - x)\,(\Delta\bar{A}/\Delta x)_{\bar{V},\bar{T}}$$

Prediction of coexisting states

With the chemical potentials now available, we are in a position to predict the location of the phase boundary. For the liquid and vapor to be in equilibrium, the chemical potential of each component must be the same on each side of the phase boundary. That is:

$$\mu_{4L}(P,T,x_L) = \mu_{4v}\,(P,T,x_v)$$

$$\text{and } \mu_{5L}(P,T,x_L) = \mu_{5v}\,(P,T,x_v), \tag{27}$$

where the subscripts L and v refer to liquid and vapor, respectively. At a specified P and T this becomes a system of two non-linear equations in the two unknowns x_L and x_v. The solutions were obtained using a commercially available package of programs for solving non-linear problems. All methods for solving systems of non-linear equations require a mechanism for guessing the values of the unknowns to be used as the initial values for an iterative process. In regions where the values of the unknowns are well separated, the requirements on the accuracy of the guesses are not very stringent. For temperatures below the critical temperature of either component, the P-x dew and bubble curves run from x=0 (vapor pressure of pure isobutane) to

x=1 (vapor pressure of pure isopentane). This can be seen graphically in fig. 7. Here an initial guess for x_L is obtained by interpolation, at the specified pressure P, on the bubble curve for the specified temperature T. The bubble curve is approximated by a straight line in P-x space, connecting the vapor pressures of the individual components. Thus

$$x_L = \frac{P_4^\circ - P}{P_4^\circ - P_5^\circ}, \tag{28}$$

where the superscript ° indicates the vapor pressure of the respective pure component. A first estimate for x_V then follows from Dalton's law applied to the vapor phase:

$$x_V = 1 - (1-x_L)P_4^\circ/P. \tag{29}$$

If the specified temperature T is between the two critical temperatures, the dew and bubble curves in P-x space begin at the isopentane vapor pressure and meet at the critical line (cf. fig. 7). We approximate the bubble curve by a straight line running from the point P_c, x_c, which is determined once T is specified, to P_5° at x=1. We now apply Raoult's law to a mixture consisting of isopentane and a virtual component with vapor pressure P_c. We then obtain as an estimate for x_L:

$$x_L = x_c + (1-x_c) \cdot \frac{P_c - P}{P_c - P_5^\circ}. \tag{30}$$

Application of Dalton's law to the vapor phase of this mixture leads to

$$x_V = 1 - (1-x_L)\, P_c/P \tag{31}$$

as a first guess of the vapor composition.

As either end point of the coexistence curve is approached, the values for x_L and x_v become nearer to each other, and the required accuracy of the initial guesses for these quantities increases, especially at the higher temperatures. This we accomplish by making our first calculation near the middle of the region of coexistence, and then approaching the ends with small increments of P, if properties along an isotherm are being calculated, or of T, if properties along an isobar are being calculated. With each calculation after the first, the initial guesses for x_L and x_v are taken as the final result of the previous calculations. Even so, a point is always reached very close to the critical point where the calculation breaks down computationally, and a solution cannot be reached.

Prediction of the critical line.

For a pure fluid, the critical point is defined as that point where $(\partial p/\partial \rho)_T$ and $(\partial^2 p/\partial \rho^2)_T$ are simultaneously zero, because of incipient mechanical instability. The critical point for a fluid mixture of two components, where x is the concentration of the second component, is defined as the point where $(\partial \mu/\partial x)_{P,T}$ and $(\partial^2 \mu/\partial x^2)_{P,T}$ are simultaneously zero because of incipient material instability. The location of this point is computed in the following way: The condition that these two derivatives be simultaneously zero can be seen, according to the definition of the μ's in eq (25), to be equivalent with requiring that $(\partial^2 G/\partial x^2)_{P,T}$ and $(\partial^3 G/\partial x^3)_{P,T}$ be simultaneously zero. The condition that $(\partial^2 G/\partial x^2)_{P,T}$ be zero defines a surface, called by van der Waals a "spinodal", which must lie within the two-phase region but be tangent to the real two-phase region at the point of maximum pressure for an isotherm plotted in the P vs x plane. (See diagram in fig. 1, and discussion in ref. (11)) This point of contact, at a maximum of P, is the point that satisfies the other condition, that $(\partial^3 G)/(\partial x^3)_{P,T}$ be zero and is the real critical point for the specified T. This point is found through a search, at the specified T and a trial x, by

scanning over a range of densities and searching for the P at the point where $(\partial^2 G/\partial x^2)_{P,T} = 0$. This search is repeated at the same T but a different x until the x is found for which the P is a maximum while $(\partial^2 G/\partial x^2)_{P,T} = 0$.

4. COMPARISONS WITH EXPERIMENTAL DATA.

For comparisons of the rather sizeable body of data available for pure isobutane with the isobutane reference function, see Waxman and Gallagher[2]. The available experimental data for isopentane are much more sparse, and additional data are being taken at this laboratory as a part of this project to supplement those already available. The vapor pressures of pure isopentane have been measured over the range from approximately 97°C to 181°C. Table 3a compares these measurements with the values predicted from the Helmholtz function. The fractional differences between the measured vapor pressures and these predicted are plotted in fig. 2. The estimated experimental uncertainties of these measurements are 0.1%. As can be seen, the predicted values agree well at the higher temperature end, but the differences become somewhat larger at the lower temperatures. Additional data at lower temperatures will be available soon, and at that time a redetermination of the shape factors can be made which should improve the lower temperature results.

The coexisting liquid and vapor densities in the range 20°C to 180°C were measured by Young[9]. These measurements were taken 90 years ago and are of unknown reliability. The comparison of these densities with the predicted values, obtained by solving the Gibbs conditions at the specified temperature, appear in Table 3b. These fractional differences between the measured and predicted values are plotted in fig. 3. The agreement is quite good for the liquid densities except at the highest temperature. On the vapor side the differences are much larger, but this is to be expected as vapor density measurements are much more difficult and were given much less weight in the determination of the shape factors. We would not want to improve these agreements if it would be at the expense of the fit to other data.

Measurements of the critical temperature and pressure for mixtures of three different compositions have been taken at this laboratory as a part of another project[13], referred to in the section on predicting the critical line. Figure 4 shows these critical temperatures as a function of the composition. The dashed line on this plot is the critical line predicted by the equation. These critical line data and the predicted values are also tabulated in Table 3c. Note that this predicted critical line lies about 2°C higher than the measurements throughout as intended for the reasons discussed earlier.

Morrison at this Laboratory has made measurements of the bubble pressures and saturated liquid densities for isobutane-isopentane mixtures. His apparatus is described in some detail in another report[13]. It is a cylindrical sapphire variable-volume phase-equilibrium apparatus, coupled to a mercury displacement pump. Observations are done of the pressure and the positions of the mercury and vapor-liquid interfaces at fixed temperatures on a sample of known mass and known overall composition. By repeating these measurements at a minimum of two compositions, but both times at the same temperature and pressure, the densities and compositions of the coexisting phases can be inferred without the need for sampling. Temperatures are measured to better than 1 mK, pressures to 0.1% by means of a calibrated pressure transducer, and the overall composition of the prepared sample is estimated to be reliable to $\pm$ 0.0002 in mole fraction. For the present contract, Morrison measured bubble pressures and saturated liquid densities for samples of 0.05 - 0.15 mole fraction of isopentane at approximately 15°C - 55°C in steps of 10°C. For another contract, he did similar measurements for samples near 50% mole fraction. All measurements are listed in Table 3d. In this same table, we also compare the predictions of the thermodynamic surface with these measured data. The comparisons are displayed in four graphs, figs. 5a - d: two figures comparing pressure and two comparing density. We note that our model predicts the densities for the 5 - 15%

mixtures to better than 1%. The densities of the 50% mixtures are predicted with errors from 1-2%. The pressures of the 5-15% mixtures are predicted to better than 0.5% at the highest temperature, but the surface does markedly worse at the lowest temperatures. For the mixtures near 50%, the vapor pressures are predicted within 1% at the highest temperature, but there are systematic departures at the lower temperature. There is therefore room for improvement. We are confident that the new data we are taking, and the flexibility still present in the model, will allow us to do much better in the next round of correlations.

Koppany and Lenoir[12] reported measurements of the enthalpy of mixtures of nominally 0.80 mole fraction of isobutane in isopentane. Enthalpies were measured by injecting the mixture into a calorimeter at fixed pressure and a measured temperature, and then cooling it isobarically to a liquid state at 75°F. The enthalpy difference to this liquid reference state is obtained from the hydrocarbon flow rate and the amount of refrigerant evaporated.

The authors performed test measurements using pure isobutane at 250 psia. We have compared their measured enthalpy differences with those predicted by our Helmholtz function for isobutane. The agreement was strikingly good.

For the mixture, seven isobars were measured, six of which were subcritical. Samples of the mixture were taken periodically throughout the runs and analyzed for composition. The authors' preference has been to use the average of these analyses as the composition, and therefore our predictions have been made for these average compositions. In fig. 6, we have displayed the data and our predictions for four of the isobars. The experimental and predicted values are also tabulated in Table 3e. Our predictions generally agree well with the data in the liquid phase, but are somewhat on the low side in the vapor phase, especially near and above the critical point. The authors' estimate of the location of the phase boundary is quite far from

the one predicted by our surface, especially at the vapor side beyond 200°F. We believe that it is very difficult to locate the phase boundary from the enthalpy data alone because of their pronounced curvature in the two-phase region. Although we have as yet no data for the saturated vapor volumes near the critical point, we do have a direct measurement of T_c at the 0.80 mole fraction of isobutane. Our measured value is about 6°F below that estimated by the authors, which is consistent with our hypothesis that the authors have overestimated the extent of the two phase region. Our surface is certainly capable of some improvement in the supercritical low-density states.

The most worrisome aspect of the data is the strong curvature of the isobars in the two-phase region. We are not hopeful that our model can be made to exhibit such curvature. We do not think that the excellent results obtained with this calorimeter for pure isobutane guarantee proper functioning if a mixture is used. In particular, in this calorimeter, the sample is entered into a side arm at the desired pressure, and then heated in a relatively short section of tubing to the initial temperature. It may not be possible for a mixture to reach complete composition equilibrium if the desired initial state is in the two-phase region. This may explain why our agreement with the one-phase data is so much better than with the two-phase data.

5. RESULTS

Some of the predicted thermodynamic properties of this resulting Helmholtz function are shown graphically in figures 7 and 8. Figure 7 displays the predicted dew-and bubble-point pressures for several sub-critical isotherms as a function of the composition. The predicted critical line is also included as a dashed line with the small circles indicating the predicted critical pressure at the temperature of these isotherms. Figure 8 similarly displays the predicted dew - and bubble-point densities and the predicted critical line. The dashed portions of the isotherms are

those parts of the isotherms within the excluded region about the critical line: that is, where $0.7 < \bar{\rho}_4 < 1.3$ and $0.985 < \bar{T}_4 < 1.015$. In the regions very close to the critical points we experience computational difficulty in the solving of the eq (27) for the conditions of coexisting phases.

Table 4 presents the predicted values for coexisting liquid and vapor. The dew-point tables were generated for a 0.1 mole fraction of isopentane in the vapor at increments of temperature and of pressure. The composition and predicted properties for the coexisting liquid are also shown. The bubble point tables were generated for a 0.1 mole fraction of isopentane in the liquid, again at increments of temperature and of pressure, and with the composition and predicted property values of the coexisting vapor.

Table 5 includes properties in the single phase region for the 0.1 mole fraction isopentane mixture. They were calculated along isobars and also include on phase boundaries the composition and properties of the coexisting state. Table 5a presents the properties in the vapor phase, Table 5b the liquid phase and Table 5c the supercritical isobars. The properties tabulated include those most needed in the design of power cycles.

Also included with this report are pressure vs. enthalpy charts for pure isobutane and a mixture of 0.1 mole fraction isopentane in isobutane. These charts were plotted by computer and show isotherms as solid lines, isochores as dashed lines, isentropes as "dash - dot" lines and, in the two phase region for the mixture, lines of constant quality as dotted lines. The isentropes were calculated using a Newton-Raphson iteration where, for the specified entropy, a range of densities was chosen and at each density the temperature was determined, where $C_v/T = (\partial S/\partial T)_\rho$ was used for the derivative in the iteration. The "excluded" region in the vicinity of the critical point is left blank in the chart for the mixture because of the expected reduction in accuracy of the values for the predicted properties in that region. In the chart for pure isobutane the plotted values in the

critical region were taken from a separate correlation of the critical region[3]; it happens to join to the global equation at the boundaries of the excluded region smoothly to within visual accuracy on the plot. In addition to the improved accuracy, the charts cover a much wider range than any heretofore available.

In Appendix A we have included the computer programs, written in FORTRAN 77, which were used to generate the predicted properties of this surface. The package includes subroutines for calculating the properties of the isobutane reference function, for applying the corresponding states principles previously described, and for converting to and from the internal dimensionless units to any of a wide variety of desired external systems of units. A main program is also included for generating a table of properties along an isobar, which was used for generating the values in Table 5.

6. ESTIMATE OF RELIABILITY

The reference function for pure isobutane is generally in accord with the sizeable body of data available for pure isobutane to within 0.1% to 0.15% differences in density over the specified range of 250 to 600 K and 0 to 40 MPa. (0 to 5800 PSIA). The predicted vapor pressures for pure isopentane differ, in the worst case, from the measured values by about 0.9% and on average by about 0.5%. Comparing the predicted coexisting densities for pure isopentane with the measured ones shows average differences of about 0.3% for the saturated liquid and up to 3% for the saturated vapor . The agreement of the bubble-point pressures for the mixture with the measurements of Morrison range from + 2.4% to - 1.4% with an average difference of about 0.8%, and for the coexisting liquid densities the range of differences is -2.0% to + 0.1% with an average difference of about -0.9%.

On the basis of these comparisons we would estimate the uncertainty of the predicted vapor pressures to be about 0.5% for pure isopentane, increasing to about 1% for the 50% mixture, then decreasing to that of the pure isobutane

as the mixture becomes more dilute in isopentane. The predicted densities might be expected to have a similar behavior. Comparing a variety of surfaces developed for the mixture, we find that the predicted enthalpies and entropies are relatively insensitive to changes in the shape factors or the critical line. Seldom did these properties change by more than one or two units in the least significant figure displayed in the tables.

The range of validity for the mixture Helmholtz function might be expected to be the same, in reduced units, as that for the pure isobutane reference function.

7. CONCLUSION

This resulting Helmholtz function describing the thermodynamic surface can be used to predict equilibrium thermodynamic functions through the entire composition range from pure isobutane to pure isopentane over a wide range of temperatures and pressures. Additional measurements are being made and as they become available, refinements will be made in the expressions for the shape factors and the mixing parameters which should further reduce the uncertainties. In particular, vapor pressure measurements are being made on pure isopentane at lower temperatures which should improve the shape factors in that region and at the same time we hope to improve the representation of the saturated vapor densities for pure isopentane at the high temperatures. Also more measurements of the PVTx relationship at the bubble points will become available: these should also lead to improvements in the shape factors. The accuracy of the predicted thermodynamic values in the single-phase regions for the pure isopentane or for the mixture has not been tested due to an absence of experimental data. We hope to have such measurements and with them test the validity of this method of prediction. This method of using a well-tested Helmholtz function for pure isobutane as the reference fluid already gives a significant improvement in accuracy over previously-used methods where both components of the mixture were referred to a third fluid as the reference fluid.

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TABLE 1.
COEFFICIENTS OF THE REFERENCE FUNCTION FOR ISOBUTANE

A00	27.849029
A01	58.138236
A02	-0.050937093
A03	2.5252496
A04	346.65236
A05	2.5515510
A06	-53.012165
A07	3.3434600
A08	-0.11945060
A09	-38.124442
X0	7.9688113

Y0	0.15388314	A10	3.0020353
Y1	-0.039169870	A11	-6.1529971
Y2	-0.25198404-03	A12	-1.4570002
Y3	0.98801205-06	A13	0.13342155
A20	3.6250	A14	-0.90043710-04

B11	-9.6153074	B23	-50.009149
B21	27.935713	B43	231.53999
B41	-125.69635	B63	-380.80769
B51	544.06550	B83	261.20687
B61	-479.48565	B14	-22.934154
B81	141.34133	B64	-14.503027
B12	-12.372626	B15	-10.167777
B32	-34.731447	B25	30.142576
B52	-575.69010	B55	-33.549797
B62	532.10066	B85	25.502886
B72	415.02454	B26	-0.53441617
B82	-423.59614	B86	0.037213690
B13	58.118955	Z0	0.38796166

TABLE 2A.
THE CRITICAL POINT OF ISOPENTANE

TEMPERATURE:	460.51 K
DENSITY:	3247.3 MOL/M3
PRESSURE:	3.3707 MPA

TABLE 2B.
PARAMETERS FOR THE SHAPE FACTOR FUNCTIONS

A1	1.0	B1	1.0
A2	0.0065	B2	-0.021
A3	-0.015	B3	-0.065

TABLE 2C.
PARAMETERS IN THE COMBINING RULES

K	0.995
L	1.002

TABLE 3A.

PURE ISOPENTANE VAPOR PRESSURES: MEASURED VS. PREDICTED

T (DEG C)	PS (BAR) MEAS	PS (BAR) PRED	% DIFF
97.635	6.8380	6.7797	0.85
112.922	9.4310	9.3466	0.89
127.379	12.4770	12.3824	0.76
138.257	15.2080	15.1103	0.64
152.363	19.3870	19.2907	0.50
164.443	23.5930	23.5239	0.29
174.845	27.7610	27.7247	0.13
181.426	30.7280	30.6895	0.13

TABLE 3B.

PURE ISOPENTANE COEXISTING DENSITIES: MEASURED VS. PREDICTED

T DEG C	SAT LIQ DENS (G/CM3) MEAS	SAT LIQ DENS (G/CM3) PRED	% DIFF	SAT VAP DENS (G/CM3) MEAS	SAT VAP DENS (G/CM3) PRED	% DIFF
20.0	0.6196	0.6192	0.06	0.00240	0.00233	2.86
40.0	0.5988	0.5995	-0.12	0.00450	0.00440	2.29
60.0	0.5769	0.5783	-0.23	0.00780	0.00768	1.57
80.0	0.5540	0.5551	-0.20	0.01280	0.01266	1.13
100.0	0.5278	0.5294	-0.30	0.02020	0.02001	0.95
120.0	0.4991	0.5002	-0.23	0.03106	0.03077	0.92
140.0	0.4642	0.4659	-0.36	0.04728	0.04677	1.07
160.0	0.4206	0.4223	-0.40	0.07289	0.07201	1.20
180.0	0.3498	0.3544	1.30	0.12580	0.12105	-3.78

TABLE 3C.

MEASURED VS. PREDICTED POINTS ON THE CRITICAL LINE

X	TC (K) MEAS	TC (K) PRED	PC (BAR) MEAS	PC (BAR) PRED
0.0	407.84	409.66	36.29	37.36
0.2001	419.92	422.18	36.77	38.01
0.3493	428.71	430.69	36.50	37.95
0.5073	437.35	439.09	36.15	37.53
1.0	460.51	462.52	33.71	34.70

TABLE 3D.

BUBBLE POINT PRESSURES AND DENSITIES: MEASURED VS. PREDICTED

T DEG K	X MOLE FR	P MEAS --- BAR ---	P PRED	% DIFF	D MEAS -- MOL/DM3 --	D PRED	% DIFF
288.890	0.0505	2.524	2.549	-0.97%	9.6108	9.6182	-0.08%
	0.0863	2.513	2.480	+1.34	9.5960	9.5835	+0.13
	0.1454	2.399	2.366	+1.38	9.5675	9.5252	+0.44
	0.4968	1.685	1.697	-0.69	9.3110	9.1620	+1.63
	0.5010	1.653	1.688	-2.14	9.3041	9.1574	+1.60
	0.5097	1.632	1.672	-2.44	9.2790	9.1482	+1.43
298.337	0.0505	3.376	3.390	-0.41	9.4233	9.4220	+0.01
	0.0863	3.336	3.299	+1.13	9.4206	9.3908	+0.32
	0.1454	3.175	3.149	+0.82	9.3800	9.3382	+0.45
	0.4968	2.270	2.270	-0.02	9.1483	9.0043	+1.60
	0.5010	2.238	2.260	-0.98	9.1449	9.0015	+1.59
308.327	0.0505	4.490	4.491	-0.02	9.2013	9.2052	-0.04
	0.0863	4.405	4.371	+0.78	9.1903	9.1780	+0.13
	0.1454	4.197	4.174	+0.55	9.1575	9.1319	+0.28
	0.4968	3.045	3.026	+0.63	8.9542	8.8314	+1.39
	0.5010	2.994	3.012	-0.61	8.9469	8.8276	+1.35
318.496	0.0505	5.869	5.865	+0.07	8.9993	8.9732	+0.29
	0.0863	5.740	5.709	+0.55	8.9839	8.9507	+0.37
	0.1454	5.464	5.453	+0.20	8.9630	8.9119	+0.57
	0.4968	4.029	3.974	+1.38	8.8137	8.6482	+1.92
	0.5010	3.965	3.957	+0.21	8.7712	8.6447	+1.46
	0.5097	3.894	3.920	-0.68	8.8082	8.6376	+1.98
328.480	0.0505	7.498	7.495	+0.04	8.7512	8.7324	+0.22
	0.0863	7.324	7.296	+0.38	8.7520	8.7150	+0.42
	0.1454	6.978	6.972	+0.09	8.7535	8.6842	+0.80
	0.4968	5.145	5.105	+0.78	8.6170	8.4600	+1.86
	0.5010	5.139	5.083	+1.10	8.5955	8.4569	+1.64

TABLE 3E.

ENTHALPIES OF THE 0.2 MOLE FRACTION MIXTURE:
("#" DENOTES A POINT IN THE PREDICTED TWO-PHASE REGION)

PRES PSIA	T DEG F	MEAS H	PRED H	DIFF BTU/LB	
80	119.00	26.60	25.80	0.80	
80	119.10	27.80	25.86	1.94	
80	122.50	75.50	71.25	4.25	#
80	122.60	77.50	72.43	5.07	#
80	123.20	81.60	79.41	2.19	#
80	124.00	86.70	88.04	-1.34	#
80	126.00	91.30	107.36	-16.06	#
80	126.80	92.60	114.31	-21.71	#
80	128.40	103.10	127.27	-24.17	#
80	128.40	127.90	127.27	0.63	#
80	128.50	130.80	128.02	2.78	#
80	131.20	141.30	147.50	-6.20	#
80	131.90	144.80	152.23	-7.44	#
80	132.20	159.40	154.24	5.16	#
80	132.30	159.60	154.85	4.75	#
80	136.00	166.70	164.90	1.80	
80	137.40	167.50	165.56	1.94	
80	142.30	167.80	167.88	-0.08	
80	142.80	169.00	168.11	0.89	
80	153.10	172.30	173.00	-0.70	
80	159.30	179.10	175.95	3.15	
80	160.10	180.70	176.34	4.36	
80	169.00	184.30	180.61	3.69	
80	170.10	183.50	181.14	2.36	
80	179.40	186.20	185.64	0.56	
80	180.40	189.30	186.12	3.18	
200	178.20	63.70	63.47	0.23	
200	179.30	63.70	64.21	-0.51	
200	183.80	68.00	67.27	0.73	
200	184.10	66.80	67.47	-0.67	
200	186.60	69.40	69.18	0.22	
200	186.80	69.10	69.32	-0.22	
200	188.30	70.30	70.35	-0.05	
200	188.50	71.10	70.49	0.61	
200	189.60	73.30	71.25	2.05	
200	190.10	73.10	71.60	1.50	
200	193.10	82.60	73.68	8.92	
200	193.80	87.00	74.17	12.83	
200	198.00	134.80	120.07	14.73	#
200	198.30	135.90	123.19	12.71	#
200	200.50	156.10	144.39	11.71	#
200	201.10	160.20	149.65	10.55	#
200	201.40	159.80	152.23	7.57	#
200	202.90	168.60	164.52	4.07	#
200	205.60	171.40	184.77	-13.37	#
200	207.10	175.20	187.32	-12.12	
200	209.20	182.90	188.55	-5.65	
200	209.30	182.20	188.60	-6.40	
200	213.90	191.60	191.58	0.02	
200	213.90	192.60	191.58	1.02	
200	215.90	194.20	192.74	1.46	
200	217.80	195.20	193.84	1.36	
200	218.20	196.60	194.07	2.53	
200	227.10	200.90	199.16	1.73	
200	227.10	200.80	199.16	1.64	
200	236.20	206.50	204.34	2.16	
200	236.60	206.40	204.57	1.83	

TABLE 3E (CONT).

ENTHALPIES OF THE 0.2 MOLE FRACTION MIXTURE:

PRES PSIA	T DEG F	MEAS H	PRED H BTU/LB	DIFF	
400	249.30	114.60	115.63	-1.03	
400	250.00	115.60	116.22	-0.62	
400	253.20	120.70	118.93	1.77	
400	253.40	120.00	119.10	0.90	
400	255.40	121.90	120.83	1.06	
400	255.40	122.50	120.83	1.67	
400	257.10	125.90	122.33	3.57	
400	257.30	125.10	122.51	2.59	
400	259.70	127.20	124.68	2.53	
400	259.80	128.00	124.77	3.23	
400	261.80	129.40	126.62	2.78	
400	262.10	131.40	126.90	4.50	
400	263.50	134.60	128.24	6.36	
400	263.70	134.80	128.43	6.37	
400	265.50	144.50	137.05	7.45	#
400	265.60	150.20	138.30	11.90	#
400	267.70	171.50	161.46	10.04	#
400	267.90	169.80	163.49	6.31	#
400	269.60	182.70	179.94	2.76	#
400	269.60	182.50	179.94	2.56	#
400	272.60	197.50	202.15	-4.65	
400	273.80	198.60	203.24	-4.64	
400	274.30	197.30	203.69	-6.39	
400	276.30	211.20	205.45	5.75	
400	279.00	215.50	207.74	7.76	
400	279.40	218.20	208.08	10.12	
400	289.80	220.80	216.30	4.50	
400	290.00	220.30	216.45	3.85	
600	260.60	124.30	122.83	1.47	
600	260.60	122.80	122.83	-0.03	
600	269.00	131.30	129.71	1.58	
600	269.10	130.60	129.80	0.80	
600	278.20	136.80	137.65	-0.85	
600	278.50	139.70	137.92	1.78	
600	284.20	145.00	143.14	1.86	
600	284.30	142.90	143.23	-0.33	
600	284.40	144.60	143.32	1.28	
600	289.30	149.40	148.08	1.32	
600	289.30	149.70	148.08	1.62	
600	291.30	150.80	150.12	0.68	
600	290.90	151.10	149.71	1.39	
600	292.20	151.90	151.05	0.85	
600	293.00	151.10	151.90	-0.80	
600	295.30	156.70	154.40	2.30	
600	295.40	155.80	154.52	1.28	
600	297.80	159.40	157.28	2.12	
600	298.30	158.70	157.88	0.82	
600	300.30	162.30	160.37	1.93	
600	300.50	163.00	160.62	2.38	
600	310.30	185.20	178.50	6.70	
600	310.90	185.30	180.34	4.96	
600	318.60	207.70	203.31	4.39	
600	318.80	206.30	203.71	2.59	

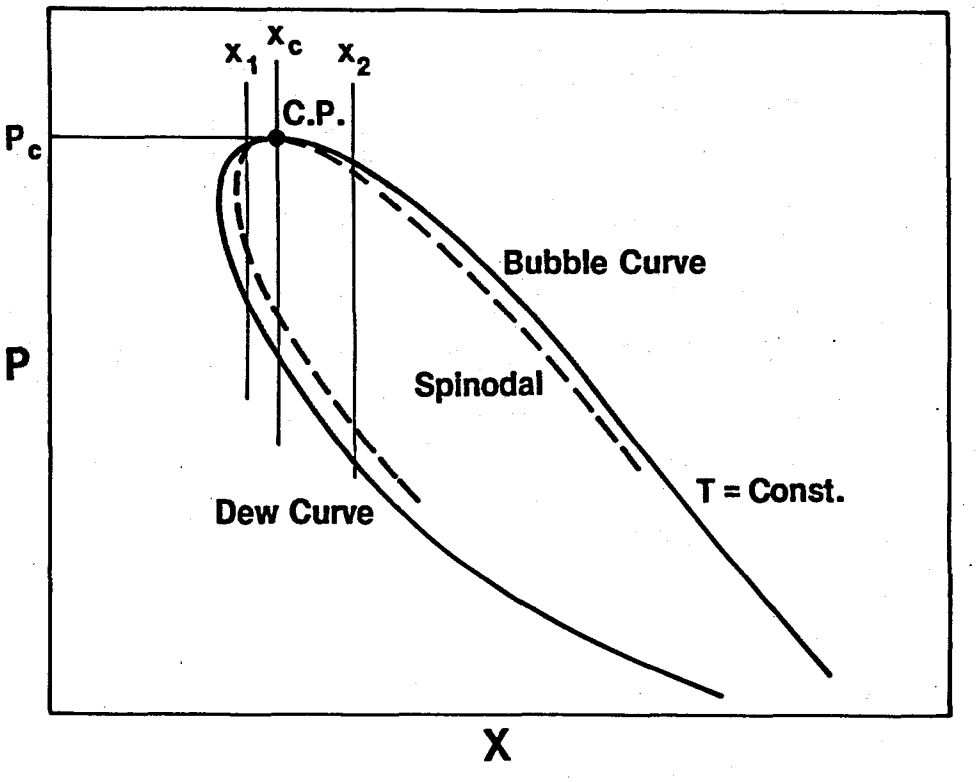


Fig. 1. Diagram showing a liquid-vapor phase boundary for a constant temperature. The critical point for that temperature, P_c and x_c, is that point where the pressure is a maximum. The dashed line represents the locus of points for which $(\partial^2 G/\partial x^2)_{TP} = 0$, and the point of maximum pressure for this function coincides with the point (P_c, x_c). This is found through a scan, at the specified T and fixed x, in which the density is varied in order to find the pressure where $(\partial^2 G/\partial x^2)_{TP} = 0$. The value of x is varied until the maximum pressure is found. This identifies P_c, x_c for this particular temperature.

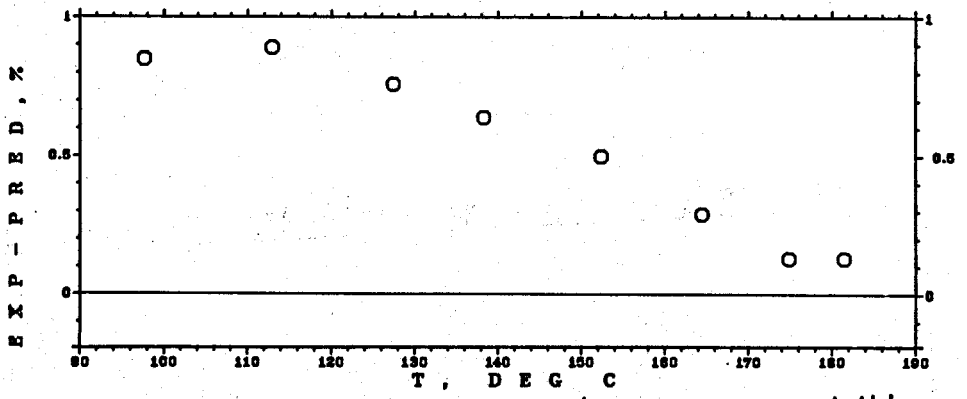


Fig. 2. Differences between measured vapor pressures at this laboratory(13) and those predicted by the surface, in %.

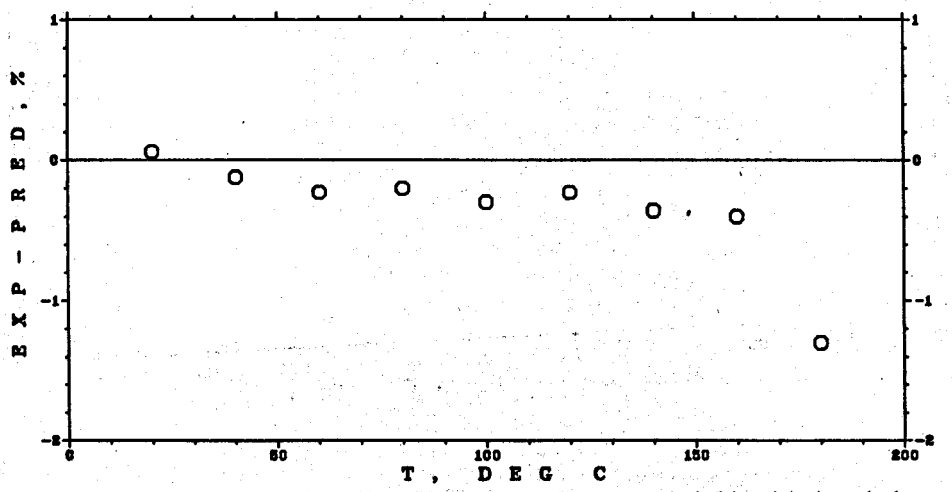


Fig. 3a. Differences between measured saturated liquid densities of Young(9) and those predicted by the surface, in %.

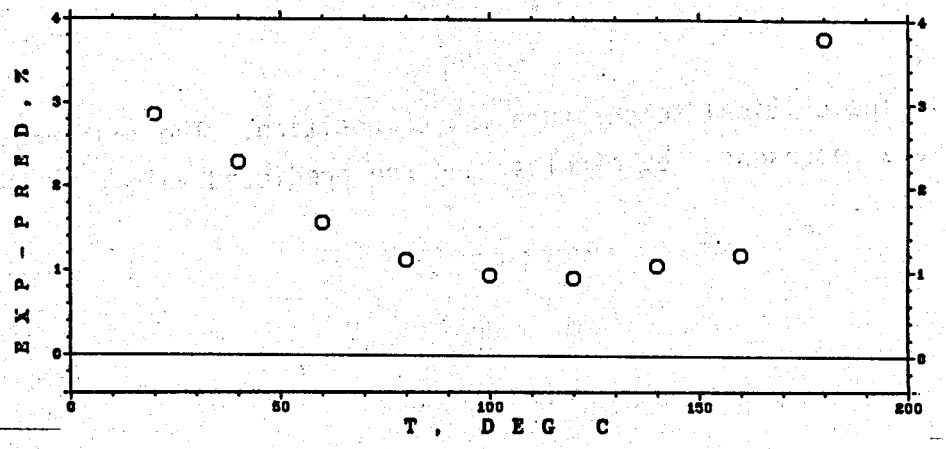


Fig. 3b. Differences between measured saturated vapor densities of Young(9) and those predicted by the surface, in %.

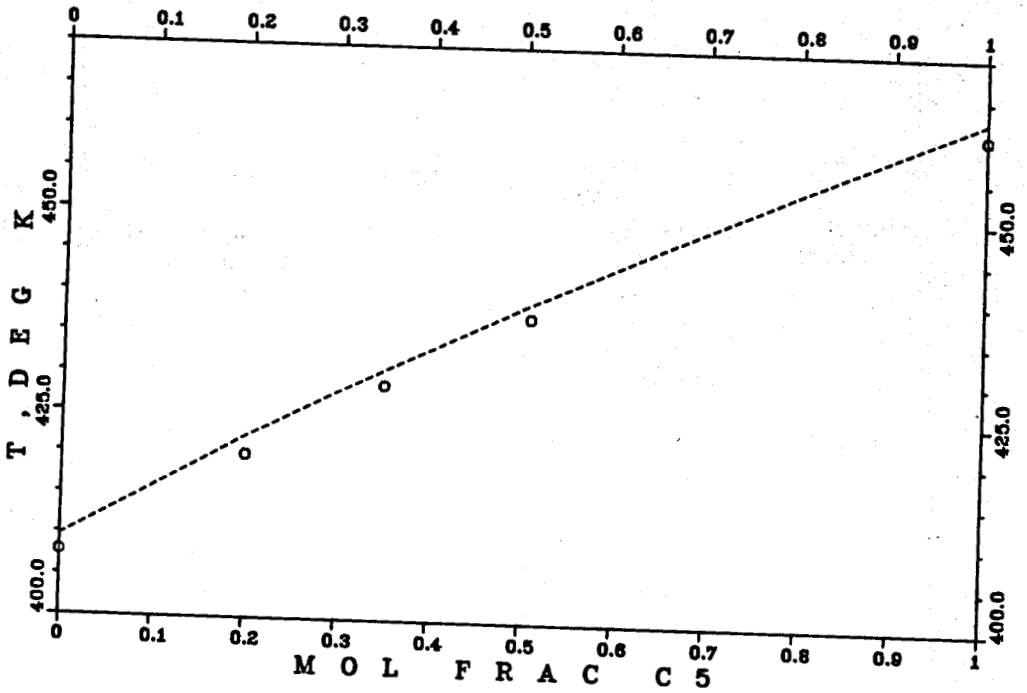


Fig. 4. The critical temperature vs. composition. The measured points are represented by circles, and the predicted values by the dashed line.

Fig. 5. Differences in % between measured bubble-points of mixtures at this laboratory and those predicted by the surface.

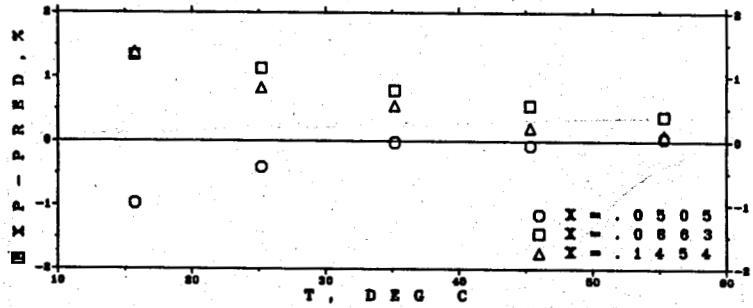


Fig. 5a. Bubble-point pressures of about 0.5 mole fraction isopentane in isobutane mixtures.

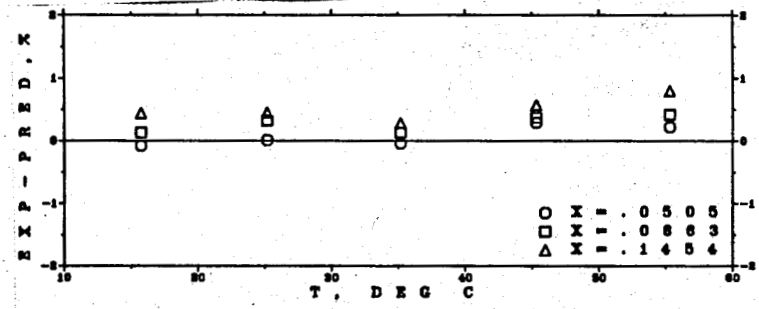


Fig. 5b. Bubble-point densities of about 0.5 mole fraction isopentane in isobutane mixtures.

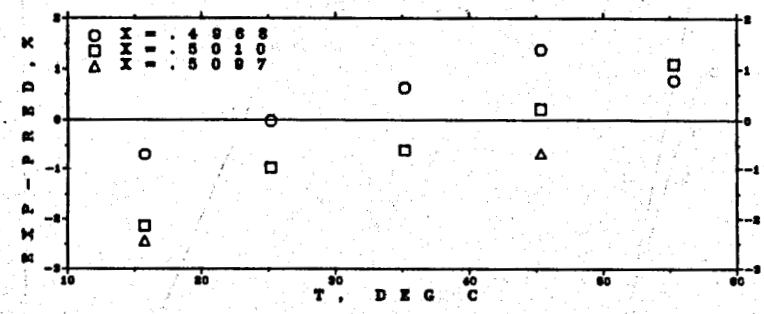


Fig. 5c. Bubble-point pressures of 0.05 to 0.15 mole fraction isopentane in isobutane mixtures.

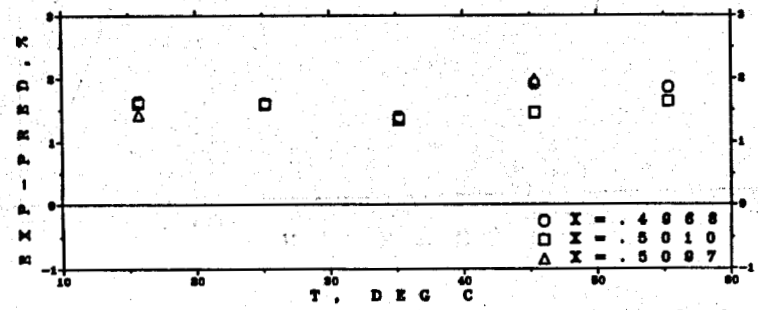


Fig. 5d. Bubble-point densities of 0.05 to 0.15 mole fraction isopentane in isobutane mixtures.

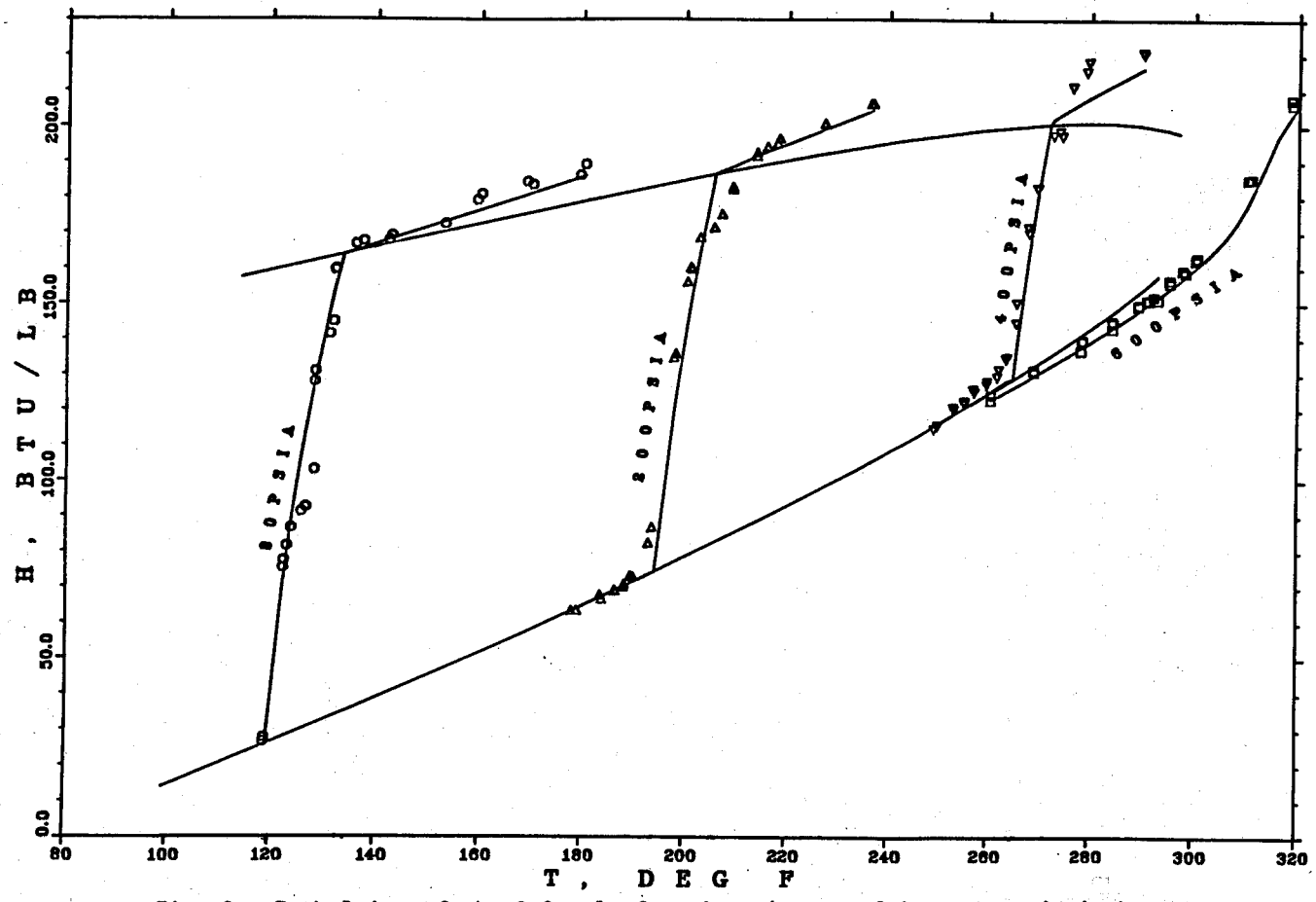


Fig. 6. Enthalpies of the 0.2 mole fraction mixture of isopentane in isobutane. The measured values(12) on isobars are indicated by symbols, and the predicted values by solid lines. The predicted boundaries of the two-phase region are also shown.

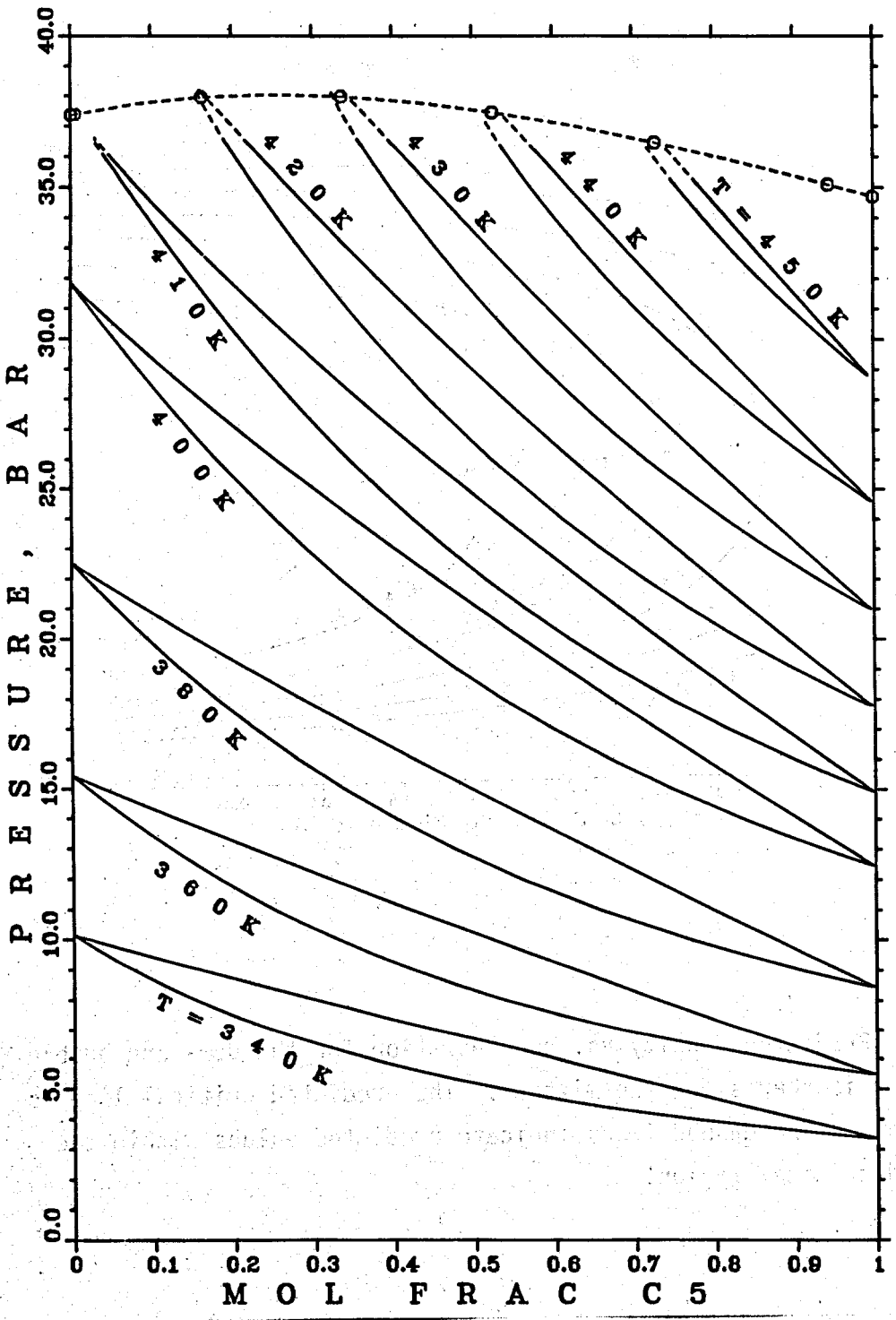


Fig. 7. Predicted pressure vs. concentration for the dew- and bubble-points on isotherms for the mixture. The predicted critical line is also shown. The dashed lines indicate predicted values within the excluded critical region.

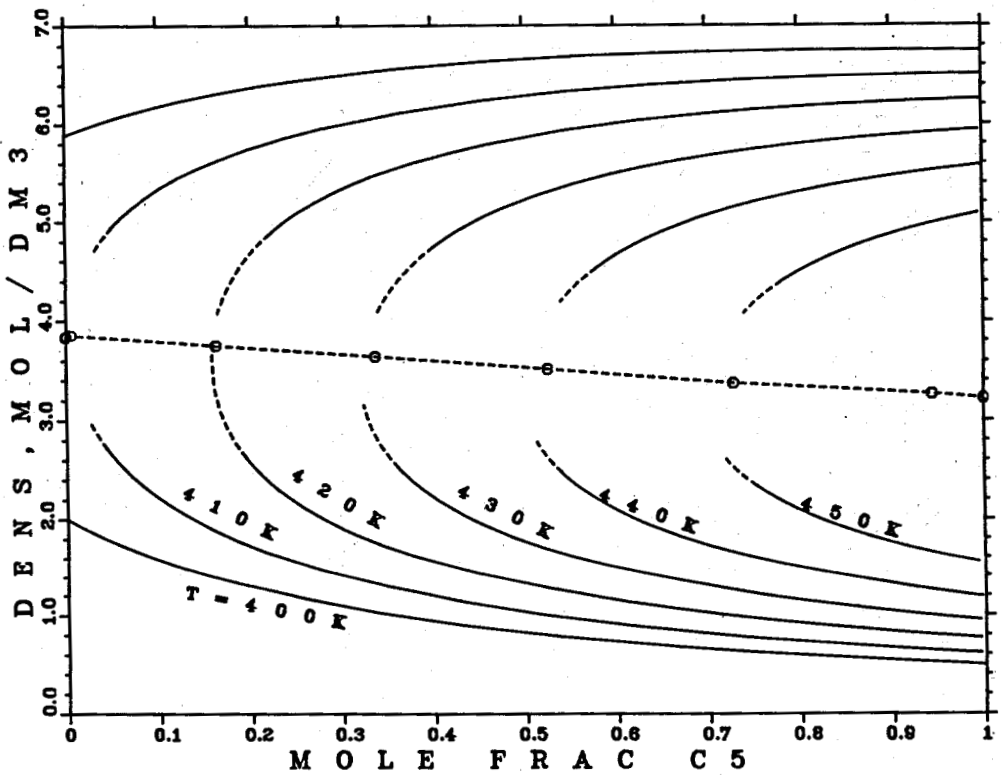


Fig. 8. Predicted density vs. concentration for the dew- and bubble-points on isotherms for the mixture. The predicted critical line is also shown. The dashed lines indicate predicted values within the excluded critical region.

TABLE 4. THERMODYNAMIC PROPERTIES ON THE VAPOR-LIQUID PHASE BOUNDARY

THE DEW POINT AT INCREMENTS OF PRESSURE

	VAPOR, X = 0.1000				------ COEXISTING LIQUID ------			
P	T	V	H	S	X	V	H	S
PSIA	DEG F	FT3/LB	BTU/LB	BTU/LB-F		FT3/LB	BTU/LB	BTU/LB-F
4.0	-28.51	19.164	-53.75	0.02994	0 3903	0.02502	-235.67	-0.36544
5.0	-20.52	15.574	-51.20	0.02845	0.3784	0.02521	-231.09	-0.35599
6.0	-13.72	13.148	-49.03	0.02740	0.3686	0.02538	-227.18	-0.34800
8.0	-2.46	10.060	-45.40	0.02603	0.3532	0.02567	-220.66	-0.33492
10.0	6.76	8.174	-42.41	0.02524	0.3413	0.02591	-215.29	-0.32433
12.0	14.62	6.897	-39.84	0.02479	0.3316	0.02612	-210.68	-0.31538
14.696	23.75	5.708	-36.86	0.02449	0.3209	0.02637	-205.31	-0.30509
20.0	38.43	4.2773	-32.01	0.02451	0.3046	0.02680	-196.53	-0.28861
25.0	49.73	3.4679	-28.26	0.02490	0.2929	0.02714	-189.68	-0.27603
30.0	59.42	2.9195	-25.04	0.02543	0.2834	0.02745	-183.76	-0.26535
35.0	67.94	2.5224	-22.21	0.02604	0.2754	0.02773	-178.51	-0.25603
40.0	75.58	2.2212	-19.68	0.02669	0.2685	0.02800	-173.77	-0.24771
45.0	82.52	1.9844	-17.38	0.02734	0.2624	0.02824	-169.43	-0.24019
50.0	88.91	1.7933	-15.27	0.02801	0.2570	0.02848	-165.41	-0.23331
55.0	94.83	1.6357	-13.32	0.02867	0.2521	0.02870	-161.66	-0.22694
60.0	100.36	1.5033	-11.51	0.02931	0.2476	0.02892	-158.13	-0.22101
70.0	110.46	1.2932	-8.22	0.03057	0.2396	0.02932	-151.63	-0.21022
80.0	119.52	1.1337	-5.28	0.03178	0.2327	0.02971	-145.72	-0.20056
90.0	127.78	1.0084	-2.64	0.03292	0.2266	0.03008	-140.27	-0.19179
100.0	135.39	0.9072	-0.23	0.03400	0.2211	0.03044	-135.19	-0.18372
110.0	142.44	0.8236	1.99	0.03503	0.2161	0.03079	-130.43	-0.17624
120.0	149.04	0.7535	4.03	0.03600	0.2115	0.03113	-125.93	-0.16925
140.0	161.10	0.6421	7.70	0.03778	0.2034	0.03180	-117.58	-0.15646
160.0	171.94	0.5574	10.91	0.03937	0.1963	0.03245	-109.92	-0.14495
180.0	181.82	0.4907	13.75	0.04079	0.1900	0.03310	-102.81	-0.13442
200.0	190.92	0.4368	16.28	0.04204	0.1842	0.03375	-96.12	-0.12469
220.0	199.37	0.3922	18.53	0.04314	0.1790	0.03440	-89.80	-0.11561
240.0	207.26	0.3546	20.53	0.04408	0.1741	0.03507	-83.77	-0.10706
260.0	214.68	0.3224	22.32	0.04488	0.1696	0.03576	-78.00	-0.09897
280.0	221.68	0.2945	23.90	0.04553	0.1652	0.03647	-72.42	-0.09126
300.0	228.31	0.2700	25.29	0.04603	0.1611	0.03721	-67.03	-0.08387
320.0	234.61	0.2482	26.49	0.04638	0.1572	0.03799	-61.79	-0.07677
340.0	240.62	0.2288	27.50	0.04657	0.1534	0.03882	-56.66	-0.06989
360.0	246.35	0.2111	28.32	0.04657	0.1497	0.03970	-51.63	-0.06320
380.0	251.84	0.1950	28.94	0.04638	0.1460	0.04065	-46.66	-0.05667
400.0	257.09	0.1802	29.34	0.04597	0.1424	0.04169	-41.74	-0.05024
420.0	262.14	0.1663	29.50	0.04530	0.1388	0.04284	-36.82	-0.04387
440.0	266.98	0.1533	29.38	0.04432	0.1351	0.04415	-31.86	-0.03751
460.0	271.62	0.1408	28.92	0.04293	0.1313	0.04566	-26.81	-0.03108
480.0	276.07	0.1287	28.01	0.04101	0.1272	0.04749	-21.56	-0.02445
500.0	280.33	0.1166	26.50	0.03835	0.1213	0.04991	-15.78	-0.01728

TABLE 4 (CONT.). THERMODYNAMIC PROPERTIES ON THE VAPOR-LIQUID PHASE BOUNDARY

THE DEW POINT AT INCREMENTS OF TEMPERATURE

	VAPOR, X = 0.1000				------ COEXISTING LIQUID ------			
T	P	V	H	S	X	V	H	S
DEG F	PSIA	FT3/LB	BTU/LB	BTU/LB-F		FT3/LB	BTU/LB	BTU/LB-F
-30.0	3.833	19.9402	-54.22	0.03025	0.3926	0.02498	-236.52	-0.36721
-20.0	5.071	15.3704	-51.04	0.02837	0.3776	0.02523	-230.79	-0.35537
-10.0	6.611	12.0135	-47.83	0.02689	0.3634	0.02547	-225.03	-0.34366
0.0	8.500	9.5093	-44.60	0.02579	0.3500	0.02573	-219.23	-0.33208
10.0	10.790	7.6144	-41.35	0.02503	0.3372	0.02600	-213.39	-0.32063
20.0	13.537	6.1629	-38.09	0.02459	0.3252	0.02627	-207.52	-0.30930
23.746	14.696	5.7078	-36.86	0.02449	0.3209	0.02637	-205.31	-0.30509
30.0	16.801	5.0363	-34.80	0.02443	0.3138	0.02655	-201.60	-0.29808
40.0	20.64	4.1523	-31.49	0.02455	0.3030	0.02685	-195.59	-0.28686
50.0	25.13	3.4513	-28.17	0.02491	0.2927	0.02715	-189.52	-0.27574
60.0	30.32	2.8900	-24.85	0.02547	0.2829	0.02747	-183.40	-0.26471
70.0	36.30	2.4364	-21.53	0.02621	0.2736	0.02780	-177.24	-0.25378
80.0	43.13	2.0666	-18.21	0.02710	0.2646	0.02815	-171.01	-0.24292
90.0	50.90	1.7629	-14.91	0.02813	0.2561	0.02852	-164.72	-0.23213
100.0	59.67	1.5115	-11.63	0.02927	0.2478	0.02890	-158.36	-0.22140
110.0	69.52	1.3019	-8.37	0.03051	0.2399	0.02931	-151.92	-0.21071
120.0	80.55	1.1261	-5.13	0.03184	0.2323	0.02973	-145.40	-0.20006
130.0	92.83	0.9776	-1.93	0.03323	0.2250	0.03018	-138.80	-0.18944
140.0	106.46	0.8515	1.22	0.03467	0.2178	0.03067	-132.08	-0.17883
150.0	121.51	0.7439	4.33	0.03614	0.2109	0.03118	-125.28	-0.16823
160.0	138.08	0.6514	7.37	0.03762	0.2041	0.03173	-118.35	-0.15763
170.0	156.27	0.5716	10.35	0.03909	0.1976	0.03233	-111.31	-0.14701
180.0	176.18	0.5024	13.24	0.04053	0.1911	0.03297	-104.13	-0.13637
190.0	197.90	0.4420	16.02	0.04192	0.1848	0.03368	-96.81	-0.12568
200.0	221.6	0.3890	18.69	0.04322	0.1786	0.03445	-89.32	-0.11492
210.0	247.2	0.3424	21.21	0.04439	0.1724	0.03532	-81.65	-0.10408
220.0	275.1	0.3010	23.53	0.04539	0.1663	0.03630	-73.77	-0.09311
230.0	305.3	0.2640	25.63	0.04614	0.1601	0.03742	-65.64	-0.08198
240.0	337.9	0.2307	27.41	0.04655	0.1538	0.03873	-57.19	-0.07060
250.0	373.2	0.2003	28.75	0.04647	0.1473	0.04031	-48.35	-0.05887
255.0	391.9	0.1860	29.21	0.04617	0.1439	0.04125	-43.73	-0.05282
260.0	411.4	0.1722	29.46	0.04562	0.1404	0.04233	-38.93	-0.04660
265.0	431.7	0.1586	29.47	0.04477	0.1367	0.04358	-33.92	-0.04014
270.0	452.9	0.1452	29.12	0.04347	0.1327	0.04510	-28.61	-0.03336
275.0	475.1	0.1316	28.28	0.04154	0.1283	0.04701	-22.88	-0.02610

TABLE 4 (CONT.). THERMODYNAMIC PROPERTIES ON THE VAPOR-LIQUID PHASE BOUNDARY

THE BUBBLE POINT AT INCREMENTS OF PRESSURE

	LIQUID, X = 0.1000				------ COEXISTING VAPOR ------			
P	T	V	H	S	X	V	H	S
PSIA	DEG F	FT3/LB	BTU/LB	BTU/LB-F		FT3/LB	BTU/LB	BTU/LB-F
4.0	-38.68	0.02546	-223.76	-0.37041	0.0186	19.0730	-51.66	0.02530
5.0	-30.55	0.02565	-219.70	-0.36089	0.0196	15.5063	-49.17	0.02383
6.0	-23.64	0.02581	-216.22	-0.35285	0.0204	13.0941	-47.04	0.02280
8.0	-12.19	0.02608	-210.38	-0.33968	0.0218	10.0251	-43.48	0.02148
10.0	-2.82	0.02632	-205.54	-0.32902	0.0230	8.1480	-40.56	0.02073
12.0	5.18	0.02652	-201.38	-0.32002	0.0240	6.8771	-38.05	0.02032
14.696	14.45	0.02677	-196.51	-0.30968	0.0252	5.6938	-35.13	0.02006
20.0	29.39	0.02718	-188.54	-0.29322	0.0271	4.2688	-30.41	0.02012
25.0	40.88	0.02751	-182.29	-0.28066	0.0287	3.4619	-26.76	0.02052
30.0	50.73	0.02781	-176.86	-0.26998	0.0300	2.9151	-23.63	0.02107
35.0	59.40	0.02809	-172.02	-0.26064	0.0312	2.5191	-20.88	0.02170
40.0	67.17	0.02834	-167.63	-0.25231	0.0323	2.2185	-18.41	0.02237
45.0	74.24	0.02858	-163.60	-0.24477	0.0333	1.9822	-16.18	0.02305
50.0	80.74	0.02881	-159.85	-0.23785	0.0342	1.7915	-14.12	0.02374
55.0	86.77	0.02903	-156.34	-0.23146	0.0351	1.6341	-12.23	0.02442
60.0	92.41	0.02924	-153.04	-0.22550	0.0360	1.5020	-10.47	0.02509
70.0	102.70	0.02964	-146.93	-0.21465	0.0375	1.2922	-7.26	0.02640
80.0	111.95	0.03002	-141.35	-0.20492	0.0389	1.1329	-4.40	0.02765
90.0	120.38	0.03039	-136.20	-0.19608	0.0403	1.0077	-1.83	0.02885
100.0	128.14	0.03074	-131.38	-0.18794	0.0415	0.9066	0.53	0.02998
110.0	135.35	0.03108	-126.85	-0.18039	0.0427	0.8231	2.68	0.03105
120.0	142.09	0.03142	-122.57	-0.17333	0.0438	0.7530	4.68	0.03207
140.0	154.42	0.03207	-114.59	-0.16041	0.0460	0.6417	8.26	0.03396
160.0	165.53	0.03272	-107.24	-0.14876	0.0480	0.5570	11.39	0.03566
180.0	175.66	0.03336	-100.39	-0.13810	0.0499	0.4904	14.16	0.03717
200.0	185.00	0.03400	-93.94	-0.12823	0.0517	0.4365	16.63	0.03853
220.0	193.68	0.03465	-87.83	-0.11901	0.0535	0.3919	18.82	0.03973
240.0	201.80	0.03532	-81.99	-0.11033	0.0553	0.3543	20.78	0.04078
260.0	209.44	0.03600	-76.37	-0.10210	0.0570	0.3221	22.52	0.04168
280.0	216.66	0.03670	-70.96	-0.09426	0.0587	0.2942	24.07	0.04244
300.0	223.52	0.03744	-65.70	-0.08673	0.0604	0.2697	25.42	0.04305
320.0	230.04	0.03822	-60.59	-0.07949	0.0621	0.2479	26.59	0.04351
340.0	236.27	0.03904	-55.58	-0.07247	0.0638	0.2284	27.57	0.04381
360.0	242.24	0.03991	-50.65	-0.06564	0.0656	0.2108	28.36	0.04393
380.0	247.96	0.04086	-45.79	-0.05895	0.0674	0.1947	28.95	0.04386
400.0	253.46	0.04190	-40.95	-0.05237	0.0692	0.1798	29.33	0.04358
420.0	258.76	0.04305	-36.12	-0.04584	0.0712	0.1660	29.47	0.04304
440.0	263.87	0.04436	-31.24	-0.03930	0.0733	0.1529	29.32	0.04220
460.0	268.80	0.04588	-26.26	-0.03267	0.0756	0.1405	28.84	0.04097
480.0	273.58	0.04771	-21.08	-0.02583	0.0782	0.1283	27.90	0.03921
500.0	278.21	0.05006	-15.54	-0.01855	0.0812	0.1160	26.33	0.03670

TABLE 4 (CONT.). THERMODYNAMIC PROPERTIES ON THE VAPOR-LIQUID PHASE BOUNDARY

THE BUBBLE POINT AT INCREMENTS OF TEMPERATURE

	LIQUID, X = 0.1000				------ COEXISTING VAPOR ------			
T	P	V	H	S	X	V	H	S
DEG F	PSIA	FT3/LB	BTU/LB	BTU/LB-F		FT3/LB	BTU/LB	BTU/LB-F
-30.0	5.075	0.02566	-219.43	-0.36024	0.0196	15.2952	-49.00	0.02374
-20.0	6.587	0.02589	-214.37	-0.34864	0.0209	12.0077	-45.92	0.02232
-10.0	8.436	0.02614	-209.25	-0.33718	0.0221	9.5429	-42.80	0.02128
0.0	10.672	0.02639	-204.08	-0.32584	0.0233	7.6699	-39.67	0.02056
10.0	13.348	0.02665	-198.85	-0.31463	0.0246	6.2278	-36.53	0.02015
14.453	14.696	0.02677	-196.51	-0.30968	0.0252	5.6938	-35.13	0.02006
20.0	16.520	0.02692	-193.56	-0.30354	0.0259	5.1046	-33.38	0.02002
30.0	20.24	0.02720	-188.21	-0.29255	0.0272	4.2203	-30.21	0.02013
40.0	24.59	0.02749	-182.77	-0.28161	0.0286	3.5167	-27.04	0.02048
50.0	29.61	0.02779	-177.26	-0.27076	0.0299	2.9518	-23.86	0.02102
60.0	35.37	0.02811	-171.68	-0.25999	0.0313	2.4940	-20.69	0.02175
70.0	41.95	0.02844	-166.02	-0.24929	0.0327	2.1200	-17.52	0.02263
80.0	49.41	0.02879	-160.28	-0.23864	0.0341	1.8121	-14.36	0.02366
90.0	57.82	0.02915	-154.45	-0.22805	0.0356	1.5568	-11.22	0.02480
100.0	67.26	0.02953	-148.54	-0.21749	0.0371	1.3436	-8.10	0.02605
110.0	77.81	0.02994	-142.53	-0.20697	0.0386	1.1644	-5.00	0.02738
120.0	89.54	0.03037	-136.43	-0.19647	0.0402	1.0129	-1.94	0.02879
130.0	102.52	0.03082	-130.22	-0.18599	0.0418	0.8841	1.09	0.03025
140.0	116.83	0.03131	-123.90	-0.17552	0.0435	0.7740	4.06	0.03176
150.0	132.57	0.03183	-117.47	-0.16504	0.0452	0.6793	6.99	0.03328
160.0	149.80	0.03239	-110.91	-0.15456	0.0470	0.5975	9.84	0.03481
170.0	168.62	0.03299	-104.23	-0.14405	0.0488	0.5265	12.63	0.03633
180.0	189.11	0.03365	-97.41	-0.13351	0.0508	0.4645	15.32	0.03781
190.0	211.4	0.03437	-90.43	-0.12292	0.0528	0.4102	17.90	0.03923
200.0	235.5	0.03516	-83.29	-0.11226	0.0549	0.3623	20.35	0.04055
210.0	261.5	0.03605	-75.96	-0.10150	0.0571	0.3198	22.65	0.04174
220.0	289.6	0.03705	-68.42	-0.09061	0.0595	0.2820	24.74	0.04275
230.0	319.9	0.03821	-60.62	-0.07954	0.0621	0.2481	26.58	0.04351
240.0	352.4	0.03957	-52.52	-0.06822	0.0649	0.2173	28.08	0.04391
250.0	387.3	0.04123	-44.02	-0.05653	0.0680	0.1891	29.12	0.04379
255.0	405.7	0.04221	-39.57	-0.05049	0.0698	0.1758	29.40	0.04345
260.0	424.8	0.04335	-34.96	-0.04427	0.0717	0.1628	29.46	0.04287
265.0	444.5	0.04468	-30.12	-0.03781	0.0738	0.1501	29.25	0.04196
270.0	465.0	0.04630	-25.00	-0.03100	0.0762	0.1374	28.65	0.04059
275.0	486.1	0.04836	-19.45	-0.02368	0.0790	0.1246	27.50	0.03854

TABLE 5A. THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS IN THE VAPOR

1 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	75.39	-57.12	0.0680	75.1	0.00240	0.327
-30.0	77.20	-53.83	0.0757	76.9	0.00234	0.333
-20.0	79.02	-50.49	0.0834	78.8	0.00229	0.339
-10.0	80.83	-47.09	0.0910	80.6	0.00224	0.344
0.0	82.64	-43.64	0.0986	82.4	0.00219	0.350
10.0	84.45	-40.13	0.1062	84.2	0.00214	0.356
20.0	86.26	-36.56	0.1137	86.1	0.00209	0.363
30.0	88.07	-32.93	0.1212	87.9	0.00205	0.369
40.0	89.88	-29.21	0.1287	89.7	0.00201	0.375
50.0	91.69	-25.43	0.1362	91.5	0.00197	0.381
60.0	93.50	-21.59	0.1437	93.3	0.00193	0.387
70.0	95.31	-17.69	0.1511	95.1	0.00189	0.393
80.0	97.12	-13.72	0.1585	97.0	0.00186	0.399
90.0	98.93	-9.69	0.1659	98.8	0.00183	0.406
100.0	100.74	-5.60	0.1733	100.6	0.00179	0.412
110.0	102.55	-1.45	0.1806	102.4	0.00176	0.418
120.0	104.36	2.76	0.1880	104.2	0.00173	0.424
130.0	106.16	7.04	0.1953	106.0	0.00170	0.431
140.0	107.97	11.38	0.2026	107.8	0.00167	0.437
150.0	109.78	15.78	0.2099	109.6	0.00164	0.443
160.0	111.59	20.24	0.2171	111.5	0.00162	0.449
170.0	113.39	24.77	0.2244	113.3	0.00159	0.456
180.0	115.20	29.36	0.2316	115.1	0.00157	0.462
190.0	117.01	34.01	0.2388	116.9	0.00154	0.468
200.0	118.81	38.72	0.2460	118.7	0.00152	0.474
210.0	120.62	43.49	0.2532	120.5	0.00150	0.481
220.0	122.42	48.33	0.2604	122.3	0.00147	0.487
230.0	124.23	53.22	0.2675	124.1	0.00145	0.493
240.0	126.04	58.18	0.2746	125.9	0.00143	0.499
250.0	127.84	63.20	0.2818	127.7	0.00141	0.505
260.0	129.65	68.28	0.2889	129.6	0.00139	0.511
270.0	131.45	73.42	0.2960	131.4	0.00137	0.517
280.0	133.26	78.62	0.3030	133.2	0.00135	0.523
290.0	135.06	83.88	0.3101	135.0	0.00134	0.529
300.0	136.87	89.19	0.3172	136.8	0.00132	0.535
310.0	138.68	94.57	0.3242	138.6	0.00130	0.541
320.0	140.48	100.01	0.3312	140.4	0.00128	0.546
330.0	142.29	105.50	0.3382	142.2	0.00127	0.552
340.0	144.09	111.05	0.3452	144.0	0.00125	0.558
350.0	145.90	116.65	0.3521	145.8	0.00124	0.564
360.0	147.70	122.32	0.3591	147.6	0.00122	0.569
370.0	149.50	128.04	0.3660	149.4	0.00121	0.575
380.0	151.31	133.81	0.3730	151.2	0.00119	0.580
390.0	153.11	139.64	0.3799	153.1	0.00118	0.586
400.0	154.92	145.53	0.3867	154.9	0.00116	0.591
420.0	158.53	157.46	0.4005	158.5	0.00114	0.602
440.0	162.14	169.60	0.4141	162.1	0.00111	0.613
460.0	165.75	181.95	0.4277	165.7	0.00109	0.623
480.0	169.35	194.51	0.4412	169.3	0.00107	0.633
500.0	172.96	207.27	0.4546	172.9	0.00104	0.643
520.0	176.57	220.22	0.4680	176.5	0.00102	0.653
540.0	180.18	233.38	0.4813	180.1	0.00100	0.663
560.0	183.79	246.72	0.4945	183.7	0.00098	0.672
580.0	187.40	260.26	0.5076	187.4	0.00096	0.682
600.0	191.00	273.98	0.5207	191.0	0.00094	0.691

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

5 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.3784)				
-20.52	0.02521	-231.09	-0.3560	1829.	62.07	0.495
-20.52	15.574	-51.20	0.0285	76.6	0.01174	0.340
-20.0	15.597	-51.03	0.0289	76.7	0.01173	0.341
-10.0	15.968	-47.61	0.0365	78.6	0.01144	0.347
0.0	16.339	-44.14	0.0442	80.5	0.01117	0.352
10.0	16.710	-40.61	0.0518	82.4	0.01092	0.358
20.0	17.079	-37.02	0.0593	84.3	0.01068	0.364
30.0	17.448	-33.37	0.0669	86.2	0.01044	0.370
40.0	17.817	-29.64	0.0744	88.1	0.01022	0.376
50.0	18.185	-25.85	0.0819	90.0	0.01001	0.382
60.0	18.553	-21.99	0.0894	91.8	0.00981	0.388
70.0	18.920	-18.07	0.0969	93.7	0.00961	0.395
80.0	19.287	-14.09	0.1043	95.6	0.00943	0.401
90.0	19.654	-10.06	0.1117	97.4	0.00925	0.407
100.0	20.021	-5.95	0.1191	99.3	0.00907	0.413
110.0	20.387	-1.79	0.1265	101.2	0.00891	0.419
120.0	20.753	2.43	0.1339	103.0	0.00875	0.425
130.0	21.118	6.72	0.1412	104.9	0.00859	0.432
140.0	21.484	11.07	0.1485	106.7	0.00845	0.438
150.0	21.849	15.48	0.1558	108.6	0.00830	0.444
160.0	22.214	19.95	0.1631	110.4	0.00816	0.450
170.0	22.578	24.49	0.1703	112.3	0.00803	0.457
180.0	22.943	29.08	0.1776	114.1	0.00790	0.463
190.0	23.307	33.74	0.1848	116.0	0.00778	0.469
200.0	23.672	38.46	0.1920	117.8	0.00766	0.475
210.0	24.036	43.24	0.1992	119.6	0.00754	0.481
220.0	24.400	48.08	0.2064	121.5	0.00742	0.487
230.0	24.764	52.99	0.2135	123.3	0.00731	0.493
240.0	25.127	57.95	0.2207	125.1	0.00721	0.499
250.0	25.491	62.97	0.2278	127.0	0.00710	0.506
260.0	25.854	68.06	0.2349	128.8	0.00700	0.512
270.0	26.218	73.20	0.2420	130.6	0.00690	0.517
280.0	26.581	78.41	0.2491	132.5	0.00681	0.523
290.0	26.944	83.67	0.2562	134.3	0.00672	0.529
300.0	27.307	88.99	0.2632	136.1	0.00663	0.535
310.0	27.670	94.38	0.2703	137.9	0.00654	0.541
320.0	28.033	99.81	0.2773	139.8	0.00645	0.547
330.0	28.396	105.31	0.2843	141.6	0.00637	0.553
340.0	28.759	110.87	0.2913	143.4	0.00629	0.558
350.0	29.121	116.48	0.2983	145.2	0.00621	0.564
360.0	29.484	122.14	0.3052	147.1	0.00613	0.570
370.0	29.847	127.87	0.3122	148.9	0.00606	0.575
380.0	30.21	133.65	0.3191	150.7	0.00599	0.581
390.0	30.57	139.48	0.3260	152.5	0.00591	0.586
400.0	30.93	145.37	0.3329	154.4	0.00584	0.592
420.0	31.66	157.31	0.3466	158.0	0.00571	0.602
440.0	32.38	169.46	0.3603	161.6	0.00558	0.613
460.0	33.11	181.81	0.3738	165.3	0.00546	0.623
480.0	33.83	194.37	0.3874	168.9	0.00534	0.634
500.0	34.56	207.14	0.4008	172.5	0.00523	0.644
520.0	35.28	220.10	0.4142	176.2	0.00512	0.653
540.0	36.00	233.26	0.4275	179.8	0.00502	0.663
560.0	36.73	246.60	0.4407	183.4	0.00492	0.673
580.0	37.45	260.14	0.4538	187.1	0.00482	0.682
600.0	38.17	273.87	0.4669	190.7	0.00473	0.691

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

10 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.3413)				
6.76	0.02591	-215.30	-0.3243	1617.4	57.31	0.514
6.76	8.174	-42.41	0.0252	79.4	0.02266	0.359
10.0	8.237	-41.25	0.0277	80.0	0.02247	0.361
20.0	8.427	-37.63	0.0353	82.0	0.02193	0.367
30.0	8.616	-33.95	0.0429	84.0	0.02141	0.373
40.0	8.805	-30.20	0.0505	86.0	0.02092	0.379
50.0	8.994	-26.38	0.0581	88.0	0.02046	0.384
60.0	9.182	-22.51	0.0656	89.9	0.02002	0.390
70.0	9.369	-18.57	0.0731	91.9	0.01960	0.396
80.0	9.556	-14.58	0.0806	93.8	0.01920	0.402
90.0	9.743	-10.52	0.0880	95.8	0.01881	0.409
100.0	9.929	-6.40	0.0955	97.7	0.01844	0.415
110.0	10.115	-2.22	0.1029	99.6	0.01809	0.421
120.0	10.301	2.02	0.1102	101.5	0.01775	0.427
130.0	10.486	6.32	0.1176	103.4	0.01743	0.433
140.0	10.672	10.68	0.1249	105.3	0.01712	0.439
150.0	10.857	15.10	0.1322	107.2	0.01682	0.445
160.0	11.041	19.58	0.1395	109.1	0.01653	0.451
170.0	11.226	24.13	0.1468	111.0	0.01625	0.458
180.0	11.410	28.74	0.1541	112.9	0.01598	0.464
190.0	11.595	33.40	0.1613	114.8	0.01572	0.470
200.0	11.779	38.13	0.1685	116.6	0.01547	0.476
210.0	11.962	42.92	0.1757	118.5	0.01522	0.482
220.0	12.146	47.77	0.1829	120.4	0.01499	0.488
230.0	12.330	52.68	0.1901	122.3	0.01476	0.494
240.0	12.513	57.66	0.1973	124.1	0.01454	0.500
250.0	12.697	62.69	0.2044	126.0	0.01432	0.506
260.0	12.880	67.78	0.2115	127.9	0.01412	0.512
270.0	13.063	72.93	0.2186	129.7	0.01391	0.518
280.0	13.246	78.14	0.2257	131.6	0.01372	0.524
290.0	13.429	83.41	0.2328	133.4	0.01353	0.530
300.0	13.612	88.74	0.2399	135.3	0.01334	0.536
310.0	13.794	94.13	0.2469	137.1	0.01316	0.542
320.0	13.977	99.58	0.2539	139.0	0.01299	0.547
330.0	14.160	105.08	0.2610	140.8	0.01282	0.553
340.0	14.342	110.64	0.2680	142.7	0.01266	0.559
350.0	14.525	116.25	0.2749	144.5	0.01249	0.564
360.0	14.707	121.93	0.2819	146.4	0.01234	0.570
370.0	14.889	127.65	0.2888	148.2	0.01218	0.576
380.0	15.071	133.44	0.2958	150.1	0.01203	0.581
390.0	15.254	139.27	0.3027	151.9	0.01189	0.587
400.0	15.436	145.17	0.3096	153.7	0.01175	0.592
420.0	15.800	157.11	0.3233	157.4	0.01147	0.603
440.0	16.164	169.27	0.3370	161.1	0.01121	0.613
460.0	16.527	181.64	0.3506	164.7	0.01096	0.624
480.0	16.891	194.20	0.3641	168.4	0.01073	0.634
500.0	17.254	206.97	0.3775	172.1	0.01050	0.644
520.0	17.617	219.94	0.3909	175.7	0.01028	0.654
540.0	17.980	233.10	0.4042	179.4	0.01007	0.663
560.0	18.343	246.46	0.4174	183.0	0.00987	0.673
580.0	18.706	260.00	0.4306	186.7	0.00968	0.682
600.0	19.069	273.73	0.4437	190.3	0.00949	0.691

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

14.696 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.3209)				
23.75	0.02637	-205.31	-0.3051	1481.2	54.17	0.525
23.75	5.708	-36.86	0.0245	80.6	0.03280	0.372
30.0	5.792	-34.53	0.0293	81.9	0.03228	0.375
40.0	5.923	-30.75	0.0369	84.0	0.03148	0.381
50.0	6.055	-26.91	0.0445	86.0	0.03074	0.387
60.0	6.185	-23.01	0.0521	88.1	0.03003	0.393
70.0	6.316	-19.06	0.0596	90.1	0.02936	0.398
80.0	6.445	-15.04	0.0672	92.1	0.02872	0.404
90.0	6.575	-10.97	0.0746	94.1	0.02812	0.410
100.0	6.704	-6.83	0.0821	96.1	0.02754	0.416
110.0	6.832	-2.64	0.0895	98.1	0.02699	0.422
120.0	6.961	1.61	0.0969	100.1	0.02646	0.428
130.0	7.089	5.93	0.1043	102.0	0.02596	0.434
140.0	7.216	10.30	0.1116	104.0	0.02548	0.440
150.0	7.344	14.74	0.1190	105.9	0.02501	0.446
160.0	7.471	19.23	0.1263	107.9	0.02457	0.453
170.0	7.598	23.79	0.1336	109.8	0.02414	0.459
180.0	7.725	28.41	0.1409	111.7	0.02373	0.465
190.0	7.852	33.08	0.1481	113.7	0.02333	0.471
200.0	7.978	37.82	0.1554	115.6	0.02295	0.477
210.0	8.104	42.62	0.1626	117.5	0.02258	0.483
220.0	8.230	47.48	0.1698	119.4	0.02222	0.489
230.0	8.356	52.40	0.1770	121.3	0.02187	0.495
240.0	8.482	57.38	0.1841	123.2	0.02154	0.501
250.0	8.608	62.42	0.1913	125.1	0.02121	0.507
260.0	8.734	67.52	0.1984	127.0	0.02090	0.513
270.0	8.859	72.68	0.2055	128.9	0.02060	0.519
280.0	8.985	77.89	0.2127	130.7	0.02030	0.525
290.0	9.110	83.17	0.2197	132.6	0.02002	0.531
300.0	9.235	88.51	0.2268	134.5	0.01974	0.536
310.0	9.360	93.90	0.2339	136.4	0.01947	0.542
320.0	9.485	99.35	0.2409	138.2	0.01921	0.548
330.0	9.610	104.86	0.2479	140.1	0.01895	0.554
340.0	9.735	110 42	0.2549	142.0	0.01870	0.559
350.0	9.860	116.04	0.2619	143.8	0.01846	0.565
360.0	9.985	121.72	0.2689	145.7	0.01823	0.570
370.0	10.110	127.45	0.2758	147.6	0.01800	0.576
380.0	10.234	133.24	0.2827	149.4	0.01777	0.582
390.0	10.359	139.08	0.2897	151.3	0.01756	0.587
400.0	10.483	144.98	0.2966	153.1	0.01734	0.592
420.0	10.732	156.93	0.3103	156.9	0.01694	0.603
440.0	10.981	169.10	0.3240	160.6	0.01655	0.614
460.0	11.229	181.47	0.3376	164.3	0.01618	0.624
480.0	11.478	194.04	0.3511	167.9	0.01582	0.634
500.0	11.726	206.82	0.3646	171.6	0.01548	0.644
520.0	11.974	219.79	0.3779	175.3	0.01516	0.654
540.0	12.221	232.96	0.3913	179.0	0.01485	0.664
560.0	12.469	246.32	0.4045	182.7	0.01455	0.673
580.0	12.717	259.87	0.4176	186.3	0.01426	0.682
600.0	12.964	273.61	0.4307	190.0	0.01399	0.692

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

20 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.3046)				
38.43	0.02680	-196.53	-0.2886	1363.5	51.38	0.535
38.43	4.277	-32.01	0.0245	81.2	0.04429	0.384
40.0	4.294	-31.41	0.0257	81.6	0.04410	0.384
50.0	4.393	-27.54	0.0334	83.8	0.04296	0.390
60.0	4.492	-23.61	0.0410	85.9	0.04188	0.395
70.0	4.590	-19.62	0.0486	88.1	0.04088	0.401
80.0	4.687	-15.58	0.0562	90.2	0.03993	0.407
90.0	4.784	-11.49	0.0637	92.3	0.03904	0.412
100.0	4.881	-7.33	0.0712	94.3	0.03819	0.418
110.0	4.977	-3.12	0.0786	96.4	0.03738	0.424
120.0	5.073	1.15	0.0861	98.4	0.03662	0.430
130.0	5.169	5.48	0.0935	100.4	0.03589	0.436
140.0	5.264	9.87	0.1009	102.5	0.03519	0.442
150.0	5.359	14.32	0.1082	104.5	0.03452	0.448
160.0	5.454	18.83	0.1156	106.5	0.03388	0.454
170.0	5.549	23.40	0.1229	108.4	0.03327	0.460
180.0	5.643	28.03	0.1302	110.4	0.03268	0.466
190.0	5.737	32.72	0.1375	112.4	0.03212	0.472
200.0	5.831	37.47	0.1447	114.3	0.03157	0.478
210.0	5.925	42.28	0.1519	116.3	0.03105	0.484
220.0	6.019	47.15	0.1592	118.2	0.03054	0.490
230.0	6.112	52.08	0.1664	120.2	0.03006	0.496
240.0	6.206	57.06	0.1735	122.1	0.02958	0.502
250.0	6.299	62.11	0.1807	124.0	0.02913	0.508
260.0	6.392	67.22	0.1879	126.0	0.02869	0.514
270.0	6.485	72.38	0.1950	127.9	0.02826	0.520
280.0	6.578	77.61	0.2021	129.8	0.02785	0.525
290.0	6.671	82.89	0.2092	131.7	0.02745	0.531
300.0	6.764	88.24	0.2163	133.6	0.02706	0.537
310.0	6.856	93.64	0.2233	135.5	0.02668	0.543
320.0	6.949	99.09	0.2304	137.4	0.02632	0.549
330.0	7.041	104.61	0.2374	139.3	0.02596	0.554
340.0	7.134	110.18	0.2444	141.2	0.02562	0.560
350.0	7.226	115.80	0.2514	143.1	0.02528	0.565
360.0	7.318	121.49	0.2584	145.0	0.02495	0.571
370.0	7.410	127.22	0.2653	146.8	0.02463	0.577
380.0	7.502	133.02	0.2723	148.7	0.02432	0.582
390.0	7.594	138.86	0.2792	150.6	0.02402	0.587
400.0	7.686	144.77	0.2861	152.5	0.02373	0.593
420.0	7.870	156.73	0.2999	156.2	0.02316	0.604
440.0	8.054	168.90	0.3135	160.0	0.02262	0.614
460.0	8.237	181.28	0.3271	163.7	0.02211	0.624
480.0	8.420	193.86	0.3407	167.4	0.02162	0.635
500.0	8.604	206.65	0.3541	171.1	0.02115	0.645
520.0	8.786	219.63	0.3675	174.8	0.02071	0.654
540.0	8.969	232.80	0.3808	178.6	0.02028	0.664
560.0	9.152	246.17	0.3941	182.3	0.01987	0.673
580.0	9.334	259.72	0.4072	186.0	0.01947	0.683
600.0	9.517	273.46	0.4203	189.6	0.01909	0.692

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

25 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.2929)				
49.73	0.02714	-189.68	-0.2760	1273.9	49.22	0.543
49.73	3.468	-28.26	0.0249	81.5	0.05520	0.393
50.0	3.471	-28.15	0.0251	81.5	0.05516	0.393
60.0	3.552	-24.19	0.0328	83.8	0.05367	0.398
70.0	3.632	-20.18	0.0404	86.1	0.05228	0.404
80.0	3.712	-16.12	0.0481	88.3	0.05098	0.409
90.0	3.792	-12.00	0.0556	90.4	0.04977	0.415
100.0	3.870	-7.82	0.0631	92.6	0.04862	0.420
110.0	3.949	-3.59	0.0706	94.7	0.04754	0.426
120.0	4.027	0.70	0.0781	96.8	0.04652	0.432
130.0	4.105	5.05	0.0855	98.9	0.04555	0.438
140.0	4.182	9.46	0.0930	101.0	0.04462	0.443
150.0	4.259	13.92	0.1003	103.1	0.04374	0.449
160.0	4.336	18.45	0.1077	105.1	0.04290	0.455
170.0	4.413	23.03	0.1150	107.1	0.04210	0.461
180.0	4.489	27.67	0.1223	109.2	0.04133	0.467
190.0	4.566	32.37	0.1296	111.2	0.04059	0.473
200.0	4.642	37.13	0.1369	113.2	0.03988	0.479
210.0	4.718	41.95	0.1442	115.2	0.03920	0.485
220.0	4.793	46.83	0.1514	117.1	0.03855	0.491
230.0	4.869	51.77	0.1586	119.1	0.03792	0.497
240.0	4.944	56.76	0.1658	121.1	0.03731	0.503
250.0	5.019	61.82	0.1730	123.0	0.03672	0.509
260.0	5.095	66.93	0.1801	125.0	0.03615	0.514
270.0	5.170	72.11	0.1873	126.9	0.03560	0.520
280.0	5.244	77.34	0.1944	128.9	0.03507	0.526
290.0	5.319	82.63	0.2015	130.8	0.03456	0.532
300.0	5.394	87.98	0.2086	132.8	0.03406	0.538
310.0	5.469	93.39	0.2157	134.7	0.03358	0.543
320.0	5.543	98.85	0.2227	136.6	0.03311	0.549
330.0	5.618	104.37	0.2297	138.5	0.03265	0.555
340.0	5.692	109.95	0.2368	140.4	0.03221	0.560
350.0	5.766	115.58	0.2438	142.4	0.03178	0.566
360.0	5.840	121.27	0.2507	144.3	0.03137	0.572
370.0	5.915	127.01	0.2577	146.2	0.03096	0.577
380.0	5.989	132.81	0.2646	148.1	0.03057	0.582
390.0	6.063	138.66	0.2716	150.0	0.03018	0.588
400.0	6.137	144.56	0.2785	151.9	0.02981	0.593
420.0	6.284	156.54	0.2922	155.6	0.02909	0.604
440.0	6.432	168.72	0.3059	159.4	0.02840	0.614
460.0	6.579	181.10	0.3196	163.2	0.02775	0.625
480.0	6.726	193.69	0.3331	166.9	0.02713	0.635
500.0	6.873	206.48	0.3466	170.7	0.02654	0.645
520.0	7.020	219.47	0.3600	174.4	0.02597	0.655
540.0	7.167	232.65	0.3733	178.1	0.02543	0.664
560.0	7.314	246.02	0.3865	181.9	0.02491	0.674
580.0	7.460	259.58	0.3997	185.6	0.02442	0.683
600.0	7.607	273.33	0.4128	189.3	0.02394	0.692

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

30 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.2834)				
59.42	0.02745	-183.76	-0.2654	1198.3	47.37	0.550
59.42	2.920	-25.04	0.0254	81.5	0.06624	0.401
60.0	2.924	-24.81	0.0259	81.6	0.06612	0.402
70.0	2.993	-20.76	0.0336	84.0	0.06427	0.407
80.0	3.061	-16.67	0.0413	86.3	0.06256	0.412
90.0	3.129	-12.52	0.0489	88.6	0.06097	0.417
100.0	3.196	-8.32	0.0564	90.8	0.05948	0.423
110.0	3.263	-4.06	0.0640	93.0	0.05808	0.428
120.0	3.329	0.25	0.0715	95.2	0.05676	0.434
130.0	3.395	4.61	0.0789	97.4	0.05552	0.439
140.0	3.460	9.03	0.0864	99.5	0.05434	0.445
150.0	3.526	13.52	0.0938	101.6	0.05323	0.451
160.0	3.591	18.05	0.1012	103.7	0.05216	0.457
170.0	3.655	22.65	0.1085	105.8	0.05115	0.462
180.0	3.720	27.30	0.1159	107.9	0.05018	0.468
190.0	3.784	32.02	0.1232	109.9	0.04926	0.474
200.0	3.848	36.79	0.1305	112.0	0.04837	0.480
210.0	3.912	41.62	0.1377	114.0	0.04752	0.486
220.0	3.976	46.51	0.1450	116.0	0.04671	0.492
230.0	4.039	51.45	0.1522	118.1	0.04592	0.498
240.0	4.103	56.46	0.1594	120.1	0.04517	0.504
250.0	4.166	61.53	0.1666	122.1	0.04444	0.509
260.0	4.229	66.65	0.1738	124.0	0.04374	0.515
270.0	4.292	71.83	0.1809	126.0	0.04306	0.521
280.0	4.355	77.07	0.1881	128.0	0.04240	0.527
290.0	4.418	82.37	0.1952	130.0	0.04177	0.533
300.0	4.481	87.72	0.2023	131.9	0.04116	0.538
310.0	4.543	93.14	0.2093	133.9	0.04056	0.544
320.0	4.606	98.61	0.2164	135.8	0.03999	0.550
330.0	4.668	104.13	0.2234	137.8	0.03943	0.555
340.0	4.731	109.71	0.2305	139.7	0.03889	0.561
350.0	4.793	115.35	0.2375	141.6	0.03836	0.567
360.0	4.855	121.04	0.2445	143.6	0.03785	0.572
370.0	4.917	126.79	0.2514	145.5	0.03736	0.578
380.0	4.979	132.59	0.2584	147.4	0.03687	0.583
390.0	5.041	138.45	0.2653	149.3	0.03640	0.588
400.0	5.103	144.36	0.2722	151.2	0.03595	0.594
420.0	5.227	156.34	0.2860	155.0	0.03507	0.604
440.0	5.351	168.53	0.2997	158.8	0.03424	0.615
460.0	5.474	180.93	0.3133	162.6	0.03344	0.625
480.0	5.597	193.52	0.3269	166.4	0.03269	0.635
500.0	5.720	206.32	0.3404	170.2	0.03197	0.645
520.0	5.843	219.31	0.3538	174.0	0.03128	0.655
540.0	5.966	232.50	0.3671	177.7	0.03062	0.665
560.0	6.088	245.88	0.3803	181.5	0.02999	0.674
580.0	6.211	259.44	0.3935	185.2	0.02939	0.683
600.0	6.333	273.19	0.4066	188.9	0.02881	0.692

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

40 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.2685)				
75.58	0.02800	-173.77	-0.2477	1075.0	44.27	0.562
75.58	2.221	-19.68	0.0267	81.1	0.08874	0.416
80.0	2.245	-17.83	0.0301	82.2	0.08753	0.418
90.0	2.299	-13.62	0.0379	84.7	0.08496	0.423
100.0	2.351	-9.36	0.0455	87.1	0.08261	0.428
110.0	2.404	-5.06	0.0532	89.5	0.08042	0.433
120.0	2.455	-0.70	0.0607	91.9	0.07839	0.438
130.0	2.507	3.70	0.0683	94.2	0.07650	0.443
140.0	2.557	8.16	0.0758	96.5	0.07472	0.449
150.0	2.608	12.68	0.0832	98.7	0.07305	0.454
160.0	2.658	17.25	0.0907	100.9	0.07147	0.460
170.0	2.708	21.88	0.0981	103.1	0.06997	0.465
180.0	2.758	26.56	0.1055	105.3	0.06855	0.471
190.0	2.807	31.30	0.1128	107.5	0.06721	0.477
200.0	2.856	36.09	0.1201	109.6	0.06592	0.482
210.0	2.905	40.94	0.1274	111.7	0.06469	0.488
220.0	2.954	45.86	0.1347	113.8	0.06352	0.494
230.0	3.003	50.82	0.1420	115.9	0.06240	0.500
240.0	3.051	55.85	0.1492	118.0	0.06132	0.505
250.0	3.099	60.93	0.1564	120.0	0.06028	0.511
260.0	3.148	66.07	0.1636	122.1	0.05929	0.517
270.0	3.196	71.27	0.1708	124.1	0.05833	0.523
280.0	3.244	76.52	0.1779	126.2	0.05740	0.528
290.0	3.291	81.84	0.1851	128.2	0.05651	0.534
300.0	3.339	87.21	0.1922	130.2	0.05565	0.540
310.0	3.387	92.63	0.1993	132.2	0.05482	0.545
320.0	3.434	98.11	0.2064	134.2	0.05402	0.551
330.0	3.482	103.65	0.2134	136.2	0.05324	0.557
340.0	3.529	109.25	0.2205	138.2	0.05248	0.562
350.0	3.576	114.89	0.2275	140.2	0.05175	0.568
360.0	3.624	120.60	0.2345	142.1	0.05104	0.573
370.0	3.671	126.36	0.2415	144.1	0.05036	0.579
380.0	3.718	132.17	0.2484	146.1	0.04969	0.584
390.0	3.765	138.04	0.2554	148.0	0.04904	0.589
400.0	3.812	143.96	0.2623	150.0	0.04841	0.595
420.0	3.905	155.95	0.2761	153.9	0.04720	0.605
440.0	3.999	168.16	0.2898	157.7	0.04605	0.616
460.0	4.092	180.57	0.3034	161.6	0.04496	0.626
480.0	4.185	193.18	0.3170	165.4	0.04393	0.636
500.0	4.278	205.99	0.3305	169.3	0.04294	0.646
520.0	4.371	218.99	0.3439	173.1	0.04200	0.656
540.0	4.464	232.19	0.3573	176.9	0.04110	0.665
560.0	4.556	245.58	0.3705	180.7	0.04024	0.675
580.0	4.649	259.16	0.3837	184.5	0.03942	0.684
600.0	4.741	272.92	0.3968	188.3	0.03863	0.693

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

50 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.2570)				
88.91	0.02848	-165.41	-0.2333	976.6	41.73	0.573
88.91	1.793	-15.27	0.0280	80.3	0.1119	0.430
90.0	1.798	-14.80	0.0289	80.6	0.1115	0.430
100.0	1.843	-10.48	0.0367	83.3	0.1079	0.434
110.0	1.887	-6.11	0.0444	85.9	0.1047	0.438
120.0	1.930	-1.70	0.0521	88.4	0.1018	0.443
130.0	1.972	2.75	0.0597	90.9	0.09902	0.448
140.0	2.015	7.26	0.0673	93.3	0.09648	0.453
150.0	2.056	11.81	0.0748	95.7	0.09412	0.458
160.0	2.098	16.42	0.0823	98.1	0.09191	0.463
170.0	2.139	21.08	0.0897	100.4	0.08983	0.469
180.0	2.180	25.79	0.0972	102.7	0.08787	0.474
190.0	2.220	30.56	0.1046	104.9	0.08602	0.479
200.0	2.261	35.38	0.1119	107.2	0.08427	0.485
210.0	2.301	40.26	0.1193	109.4	0.08261	0.491
220.0	2.341	45.19	0.1266	111.6	0.08102	0.496
230.0	2.380	50.18	0.1339	113.7	0.07951	0.502
240.0	2.420	55.22	0.1411	115.9	0.07807	0.507
250.0	2.459	60.33	0.1484	118.0	0.07668	0.513
260.0	2.498	65.48	0.1556	120.1	0.07536	0.519
270.0	2.537	70.70	0.1628	122.3	0.07409	0.524
280.0	2.576	75.97	0.1700	124.3	0.07287	0.530
290.0	2.615	81.30	0.1771	126.4	0.07169	0.536
300.0	2.654	86.68	0.1843	128.5	0.07056	0.541
310.0	2.693	92.12	0.1914	130.6	0.06947	0.547
320.0	2.731	97.62	0.1985	132.6	0.06841	0.552
330.0	2.770	103.17	0.2055	134.6	0.06739	0.558
340.0	2.808	108.77	0.2126	136.7	0.06641	0.563
350.0	2.846	114.44	0.2196	138.7	0.06546	0.569
360.0	2.885	120.15	0.2266	140.7	0.06453	0.574
370.0	2.923	125.92	0.2336	142.7	0.06364	0.580
380.0	2.961	131.74	0.2406	144.7	0.06277	0.585
390.0	2.999	137.62	0.2476	146.7	0.06193	0.590
400.0	3.037	143.55	0.2545	148.7	0.06112	0.596
420.0	3.112	155.56	0.2683	152.7	0.05955	0.606
440.0	3.188	167.79	0.2821	156.6	0.05807	0.616
460.0	3.263	180.21	0.2957	160.5	0.05667	0.627
480.0	3.338	192.84	0.3093	164.4	0.05534	0.637
500.0	3.413	205.66	0.3228	168.3	0.05408	0.646
520.0	3.488	218.68	0.3362	172.2	0.05287	0.656
540.0	3.563	231.89	0.3496	176.1	0.05172	0.666
560.0	3.637	245.29	0.3628	179.9	0.05062	0.675
580.0	3.711	258.88	0.3760	183.7	0.04958	0.684
600.0	3.786	272.65	0.3892	187.6	0.04857	0.693

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

60 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.2476)				
100.36	0.02892	-158.13	-0.2210	894.8	39.57	0.584
100.36	1.503	-11.51	0.0293	79.3	0.1357	0.442
110.0	1.540	-7.23	0.0369	82.0	0.1313	0.445
120.0	1.578	-2.76	0.0447	84.8	0.1271	0.449
130.0	1.615	1.75	0.0524	87.5	0.1233	0.453
140.0	1.652	6.31	0.0600	90.1	0.1198	0.458
150.0	1.688	10.91	0.0677	92.6	0.1166	0.462
160.0	1.724	15.55	0.0752	95.1	0.1136	0.467
170.0	1.759	20.25	0.0827	97.6	0.1108	0.472
180.0	1.794	25.00	0.0902	100.0	0.1082	0.477
190.0	1.829	29.80	0.0977	102.4	0.1058	0.482
200.0	1.863	34.65	0.1051	104.7	0.1035	0.488
210.0	1.897	39.55	0.1125	107.0	0.1013	0.493
220.0	1.931	44.51	0.1198	109.3	0.09926	0.499
230.0	1.965	49.52	0.1271	111.5	0.09731	0.504
240.0	1.999	54.59	0.1344	113.8	0.09545	0.509
250.0	2.032	59.71	0.1417	116.0	0.09368	0.515
260.0	2.065	64.89	0.1489	118.2	0.09198	0.521
270.0	2.098	70.12	0.1562	120.3	0.09036	0.526
280.0	2.131	75.41	0.1634	122.5	0.08881	0.532
290.0	2.164	80.75	0.1705	124.6	0.08732	0.537
300.0	2.197	86.15	0.1777	126.8	0.08589	0.543
310.0	2.230	91.61	0.1848	128.9	0.08451	0.548
320.0	2.262	97.12	0.1919	131.0	0.08319	0.554
330.0	2.295	102.68	0.1990	133.1	0.08191	0.559
340.0	2.327	108.30	0.2061	135.2	0.08067	0.564
350.0	2.360	113.97	0.2131	137.2	0.07948	0.570
360.0	2.392	119.70	0.2202	139.3	0.07833	0.575
370.0	2.424	125.48	0.2272	141.3	0.07721	0.581
380.0	2.456	131.31	0.2342	143.4	0.07613	0.586
390.0	2.488	137.20	0.2411	145.4	0.07509	0.591
400.0	2.520	143.14	0.2481	147.5	0.07407	0.597
420.0	2.584	155.17	0.2619	151.5	0.07213	0.607
440.0	2.647	167.41	0.2757	155.5	0.07030	0.617
460.0	2.710	179.85	0.2893	159.5	0.06857	0.627
480.0	2.773	192.49	0.3029	163.4	0.06693	0.637
500.0	2.836	205.33	0.3165	167.4	0.06537	0.647
520.0	2.899	218.36	0.3299	171.3	0.06389	0.657
540.0	2.962	231.58	0.3433	175.2	0.06248	0.666
560.0	3.024	244.99	0.3565	179.1	0.06114	0.676
580.0	3.087	258.59	0.3698	183.0	0.05985	0.685
600.0	3.149	272.37	0.3829	186.9	0.05862	0.694

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

80 PSIA

T .DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.2327)				
119.52	0.02971	-145.72	-0.2006	763.9	36.01	0.602
119.52	1.134	-5.28	0.0318	76.9	0.1857	0.464
120.0	1.135	-5.06	0.0322	77.1	0.1854	0.464
130.0	1.166	-0.41	0.0401	80.2	0.1784	0.466
140.0	1.196	4.27	0.0480	83.3	0.1722	0.469
150.0	1.225	8.98	0.0558	86.2	0.1666	0.473
160.0	1.254	13.73	0.0635	89.0	0.1614	0.476
170.0	1.282	18.51	0.0712	91.8	0.1568	0.480
180.0	1.310	23.34	0.0788	94.4	0.1525	0.485
190.0	1.338	28.21	0.0863	97.1	0.1485	0.489
200.0	1.365	33.13	0.0938	99.6	0.1448	0.494
210.0	1.392	38.09	0.1013	102.2	0.1414	0.499
220.0	1.419	43.10	0.1087	104.6	0.1382	0.504
230.0	1.445	48.17	0.1161	107.1	0.1351	0.509
240.0	1.472	53.28	0.1235	109.5	0.1323	0.514
250.0	1.498	58.45	0.1308	111.8	0.1296	0.519
260.0	1.524	63.67	0.1381	114.2	0.1270	0.525
270.0	1.549	68.94	0.1454	116.5	0.1246	0.530
280.0	1.575	74.27	0.1527	118.8	0.1222	0.535
290.0	1.600	79.65	0.1599	121.1	0.1200	0.540
300.0	1.626	85.08	0.1671	123.3	0.1179	0.546
310.0	1.651	90.56	0.1743	125.5	0.1159	0.551
320.0	1.676	96.10	0.1814	127.7	0.1139	0.556
330.0	1.701	101.69	0.1885	129.9	0.1121	0.562
340.0	1.726	107.34	0.1956	132.1	0.1103	0.567
350.0	1.751	113.03	0.2027	134.3	0.1085	0.572
360.0	1.776	118.78	0.2098	136.4	0.1069	0.578
370.0	1.800	124.59	0.2168	138.6	0.1053	0.583
380.0	1.825	130.44	0.2238	140.7	0.1037	0.588
390.0	1.849	136.35	0.2308	142.8	0.1022	0.593
400.0	1.874	142.31	0.2378	144.9	0.1008	0.598
420.0	1.923	154.38	0.2517	149.1	0.09800	0.609
440.0	1.971	166.66	0.2655	153.3	0.09541	0.619
460.0	2.019	179.13	0.2792	157.4	0.09296	0.629
480.0	2.067	191.80	0.2928	161.5	0.09065	0.639
500.0	2.115	204.66	0.3063	165.5	0.08847	0.648
520.0	2.163	217.72	0.3198	169.5	0.08640	0.658
540.0	2.211	230.97	0.3332	173.6	0.08443	0.667
560.0	2.258	244.40	0.3465	177.6	0.08256	0.677
580.0	2.306	258.02	0.3597	181.5	0.08077	0.686
600.0	2.353	271.83	0.3729	185.5	0.07907	0.695

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

100 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.2211)				
135.39	0.03044	-135.19	-0.1837	661.6	33.11	0.620
135.39	0.907	-0.23	0.0340	74.2	0.2389	0.485
140.0	0.919	2.01	0.0378	75.8	0.2341	0.485
150.0	0.945	6.87	0.0458	79.2	0.2248	0.486
160.0	0.970	11.74	0.0537	82.5	0.2165	0.488
170.0	0.995	16.64	0.0616	85.6	0.2090	0.491
180.0	1.019	21.56	0.0693	88.6	0.2023	0.494
190.0	1.042	26.52	0.0770	91.5	0.1962	0.498
200.0	1.065	31.52	0.0846	94.4	0.1906	0.502
210.0	1.088	36.55	0.0922	97.1	0.1855	0.506
220.0	1.111	41.63	0.0997	99.8	0.1807	0.510
230.0	1.133	46.76	0.1072	102.5	0.1763	0.515
240.0	1.155	51.93	0.1147	105.0	0.1721	0.519
250.0	1.176	57.14	0.1221	107.6	0.1682	0.524
260.0	1.198	62.41	0.1294	110.1	0.1646	0.529
270.0	1.219	67.72	0.1368	112.6	0.1611	0.534
280.0	1.241	73.09	0.1441	115.0	0.1579	0.539
290.0	1.262	78.51	0.1514	117.4	0.1548	0.544
300.0	1.283	83.97	0.1586	119.8	0.1518	0.549
310.0	1.303	89.49	0.1658	122.1	0.1490	0.554
320.0	1.324	95.06	0.1730	124.5	0.1463	0.559
330.0	1.345	100.68	0.1802	126.8	0.1438	0.565
340.0	1.365	106.36	0.1873	129.0	0.1413	0.570
350.0	1.386	112.08	0.1944	131.3	0.1390	0.575
360.0	1.406	117.86	0.2015	133.6	0.1367	0.580
370.0	1.426	123.68	0.2086	135.8	0.1346	0.585
380.0	1.446	129.56	0.2156	138.0	0.1325	0.590
390.0	1.466	135.49	0.2226	140.2	0.1305	0.595
400.0	1.486	141.47	0.2296	142.4	0.1285	0.601
420.0	1.526	153.58	0.2436	146.7	0.1248	0.611
440.0	1.565	165.89	0.2574	151.0	0.1214	0.621
460.0	1.605	178.40	0.2711	155.3	0.1182	0.631
480.0	1.644	191.10	0.2848	159.5	0.1151	0.640
500.0	1.683	203.99	0.2984	163.6	0.1122	0.650
520.0	1.722	217.08	0.3119	167.8	0.1095	0.659
540.0	1.760	230.35	0.3253	171.9	0.1070	0.669
560.0	1.799	243.81	0.3386	176.0	0.1045	0.678
580.0	1.837	257.45	0.3519	180.1	0.1022	0.687
600.0	1.875	271.28	0.3650	184.1	0.1000	0.696

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

120 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.2115)				
149.04	0.03111	-125.9	-0.1693	578.	30.67	0.636
149.04	0.754	4.0	0.0360	71.3	0.2954	0.505
150.0	0.756	4.5	0.0368	71.7	0.2940	0.504
160.0	0.779	9.6	0.0450	75.5	0.2808	0.504
170.0	0.801	14.6	0.0531	79.0	0.2693	0.504
180.0	0.823	19.6	0.0610	82.5	0.2591	0.506
190.0	0.844	24.7	0.0689	85.7	0.2500	0.508
200.0	0.864	29.8	0.0767	88.9	0.2417	0.511
210.0	0.884	34.9	0.0844	91.9	0.2343	0.514
220.0	0.904	40.1	0.0920	94.8	0.2275	0.517
230.0	0.924	45.3	0.0996	97.7	0.2212	0.521
240.0	0.943	50.5	0.1071	100.5	0.2154	0.525
250.0	0.962	55.8	0.1146	103.3	0.2100	0.530
260.0	0.981	61.1	0.1221	105.9	0.2050	0.534
270.0	0.999	66.5	0.1295	108.6	0.2003	0.539
280.0	1.017	71.9	0.1368	111.2	0.1959	0.543
290.0	1.036	77.3	0.1442	113.7	0.1917	0.548
300.0	1.054	82.8	0.1515	116.2	0.1878	0.553
310.0	1.071	88.4	0.1587	118.7	0.1841	0.558
320.0	1.089	94.0	0.1659	121.1	0.1805	0.563
330.0	1.107	99.7	0.1732	123.6	0.1772	0.568
340.0	1.124	105.4	0.1803	126.0	0.1740	0.573
350.0	1.142	111.1	0.1875	128.3	0.1709	0.578
360.0	1.159	116.9	0.1946	130.7	0.1680	0.583
370.0	1.176	122.8	0.2017	133.0	0.1652	0.588
380.0	1.194	128.7	0.2088	135.3	0.1625	0.593
390.0	1.211	134.6	0.2158	137.6	0.1599	0.598
400.0	1.228	140.6	0.2228	139.8	0.1574	0.603
420.0	1.261	152.8	0.2368	144.3	0.1527	0.613
440.0	1.295	165.1	0.2507	148.8	0.1483	0.622
460.0	1.328	177.7	0.2645	153.2	0.1442	0.632
480.0	1.361	190.4	0.2782	157.5	0.1403	0.642
500.0	1.394	203.3	0.2918	161.8	0.1367	0.651
520.0	1.427	216.4	0.3053	166.0	0.1333	0.661
540.0	1.460	229.7	0.3187	170.2	0.1301	0.670
560.0	1.492	243.2	0.3321	174.4	0.1270	0.679
580.0	1.525	256.9	0.3454	178.6	0.1241	0.688
600.0	1.557	270.7	0.3586	182.7	0.1213	0.697

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

140 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.2034)				
161.10	0.03178	-117.6	-0.1566	508.	28.54	0.652
161.10	0.642	7.7	0.0378	68.3	0.3554	0.524
170.0	0.661	12.4	0.0452	72.0	0.3398	0.522
180.0	0.681	17.6	0.0534	75.9	0.3245	0.520
190.0	0.701	22.8	0.0615	79.6	0.3111	0.520
200.0	0.720	28.0	0.0695	83.1	0.2992	0.522
210.0	0.738	33.2	0.0773	86.5	0.2887	0.523
220.0	0.756	38.5	0.0851	89.7	0.2792	0.526
230.0	0.774	43.7	0.0928	92.8	0.2705	0.529
240.0	0.791	49.0	0.1005	95.9	0.2626	0.532
250.0	0.808	54.4	0.1080	98.8	0.2553	0.536
260.0	0.825	59.8	0.1156	101.7	0.2486	0.540
270.0	0.841	65.2	0.1230	104.5	0.2424	0.544
280.0	0.858	70.6	0.1305	107.2	0.2366	0.548
290.0	0.874	76.1	0.1379	110.0	0.2311	0.552
300.0	0.890	81.7	0.1452	112.6	0.2260	0.557
310.0	0.906	87.3	0.1525	115.2	0.2212	0.562
320.0	0.921	92.9	0.1598	117.8	0.2167	0.566
330.0	0.937	98.6	0.1671	120.3	0.2124	0.571
340.0	0.952	104.3	0.1743	122.8	0.2083	0.576
350.0	0.968	110.1	0.1815	125.3	0.2044	0.581
360.0	0.983	116.0	0.1886	127.8	0.2007	0.585
370.0	0.998	121.8	0.1957	130.2	0.1971	0.590
380.0	1.013	127.8	0.2028	132.6	0.1937	0.595
390.0	1.028	133.7	0.2099	134.9	0.1905	0.600
400.0	1.043	139.8	0.2170	137.3	0.1874	0.605
420.0	1.072	152.0	0.2310	141.9	0.1815	0.615
440.0	1.102	164.3	0.2449	146.5	0.1761	0.624
460.0	1.131	176.9	0.2587	151.0	0.1710	0.634
480.0	1.160	189.7	0.2725	155.5	0.1663	0.643
500.0	1.188	202.6	0.2861	159.9	0.1619	0.653
520.0	1.217	215.8	0.2997	164.3	0.1577	0.662
540.0	1.245	229.1	0.3131	168.6	0.1538	0.671
560.0	1.273	242.6	0.3265	172.9	0.1500	0.680
580.0	1.302	256.3	0.3398	177.1	0.1465	0.689
600.0	1.330	270.2	0.3530	181.4	0.1432	0.698

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

160 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.1963)				
171.94	0.03243	-109.9	-0.1450	448.	26.66	0.667
171.94	0.5574	10.9	0.0394	65.3	0.4193	0.544
180.0	0.5732	15.3	0.0462	68.9	0.4011	0.539
190.0	0.5920	20.7	0.0546	73.1	0.3815	0.536
200.0	0.610	26.0	0.0628	77.0	0.3646	0.535
210.0	0.627	31.4	0.0708	80.8	0.3498	0.535
220.0	0.644	36.7	0.0788	84.3	0.3367	0.536
230.0	0.660	42.1	0.0866	87.8	0.3249	0.538
240.0	0.676	47.5	0.0944	91.0	0.3143	0.540
250.0	0.692	52.9	0.1021	94.2	0.3046	0.543
260.0	0.707	58.3	0.1097	97.3	0.2958	0.546
270.0	0.723	63.8	0.1172	100.3	0.2877	0.550
280.0	0.737	69.3	0.1247	103.3	0.2802	0.553
290.0	0.752	74.9	0.1322	106.1	0.2732	0.557
300.0	0.767	80.5	0.1396	108.9	0.2667	0.561
310.0	0.781	86.1	0.1470	111.7	0.2606	0.566
320.0	0.795	91.8	0.1543	114.4	0.2549	0.570
330.0	0.809	97.5	0.1616	117.1	0.2495	0.575
340.0	0.823	103.3	0.1689	119.7	0.2444	0.579
350.0	0.837	109.1	0.1761	122.3	0.2395	0.584
360.0	0.850	115.0	0.1833	124.8	0.2349	0.588
370.0	0.864	120.9	0.1905	127.3	0.2306	0.593
380.0	0.877	126.8	0.1976	129.8	0.2264	0.598
390.0	0.891	132.8	0.2047	132.3	0.2224	0.603
400.0	0.904	138.9	0.2118	134.7	0.2186	0.607
420.0	0.931	151.1	0.2258	139.6	0.2115	0.617
440.0	0.957	163.6	0.2398	144.3	0.2049	0.626
460.0	0.983	176.2	0.2537	148.9	0.1988	0.636
480.0	1.008	189.0	0.2674	153.5	0.1931	0.645
500.0	1.034	202.0	0.2811	158.1	0.1877	0.654
520.0	1.059	215.1	0.2947	162.5	0.1828	0.663
540.0	1.084	228.5	0.3082	167.0	0.1781	0.672
560.0	1.109	242.0	0.3216	171.3	0.1736	0.681
580.0	1.134	255.7	0.3349	175.7	0.1695	0.690
600.0	1.159	269.6	0.3482	180.0	0.1655	0.699

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

180 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1900)					
181.82	0.03308	-102.8	-0.1345	396.	24.97	0.683
181.82	0.4907	13.8	0.0408	62.2	0.4870	0.564
190.0	0.5059	18.3	0.0479	66.1	0.4640	0.557
200.0	0.5234	23.9	0.0564	70.6	0.4398	0.552
210.0	0.5401	29.4	0.0647	74.8	0.4191	0.549
220.0	0.5562	34.9	0.0728	78.7	0.4011	0.548
230.0	0.5717	40.4	0.0808	82.5	0.3853	0.548
240.0	0.5868	45.9	0.0887	86.1	0.3712	0.549
250.0	0.601	51.4	0.0965	89.5	0.3585	0.551
260.0	0.616	56.9	0.1042	92.9	0.3471	0.553
270.0	0.630	62.4	0.1119	96.1	0.3366	0.556
280.0	0.644	68.0	0.1195	99.2	0.3270	0.559
290.0	0.657	73.6	0.1270	102.3	0.3182	0.563
300.0	0.671	79.3	0.1345	105.2	0.3100	0.566
310.0	0.684	85.0	0.1419	108.1	0.3024	0.570
320.0	0.697	90.7	0.1493	111.0	0.2953	0.574
330.0	0.710	96.4	0.1567	113.8	0.2886	0.578
340.0	0.722	102.2	0.1640	116.5	0.2823	0.583
350.0	0.735	108.1	0.1713	119.2	0.2764	0.587
360.0	0.747	114.0	0.1785	121.9	0.2708	0.591
370.0	0.760	119.9	0.1857	124.5	0.2655	0.596
380.0	0.772	125.9	0.1929	127.1	0.2605	0.601
390.0	0.784	131.9	0.2000	129.7	0.2557	0.605
400.0	0.796	138.0	0.2071	132.2	0.2511	0.610
420.0	0.820	150.3	0.2212	137.2	0.2425	0.619
440.0	0.844	162.8	0.2352	142.0	0.2346	0.628
460.0	0.867	175.4	0.2491	146.8	0.2274	0.637
480.0	0.891	188.3	0.2630	151.5	0.2206	0.647
500.0	0.914	201.3	0.2767	156.2	0.2144	0.656
520.0	0.936	214.5	0.2903	160.8	0.2085	0.665
540.0	0.959	227.9	0.3038	165.3	0.2030	0.674
560.0	0.982	241.4	0.3172	169.8	0.1978	0.683
580.0	1.004	255.2	0.3306	174.2	0.1929	0.691
600.0	1.026	269.1	0.3438	178.6	0.1883	0.700

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

200 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.1842)				
190.92	0.03373	-96.1	-0.1248	349.	23.43	0.699
190.92	0.4369	16.3	0.0420	59.0	0.5591	0.585
200.0	0.4528	21.5	0.0501	63.7	0.5278	0.575
210.0	0.4693	27.2	0.0587	68.4	0.4988	0.568
220.0	0.4850	32.9	0.0671	72.9	0.4741	0.563
230.0	0.5000	38.5	0.0753	77.0	0.4528	0.561
240.0	0.5145	44.1	0.0833	80.9	0.4342	0.560
250.0	0.5285	49.7	0.0913	84.7	0.4177	0.561
260.0	0.5421	55.4	0.0991	88.3	0.4029	0.562
270.0	0.5554	61.0	0.1069	91.7	0.3896	0.564
280.0	0.5683	66.6	0.1146	95.1	0.3775	0.566
290.0	0.5810	72.3	0.1222	98.3	0.3664	0.569
300.0	0.5935	78.0	0.1298	101.5	0.3562	0.572
310.0	0.606	83.7	0.1373	104.5	0.3468	0.575
320.0	0.618	89.5	0.1447	107.5	0.3381	0.579
330.0	0.630	95.3	0.1521	110.5	0.3299	0.583
340.0	0.642	101.2	0.1595	113.3	0.3223	0.587
350.0	0.653	107.1	0.1668	116.2	0.3152	0.591
360.0	0.665	113.0	0.1741	118.9	0.3084	0.595
370.0	0.676	119.0	0.1813	121.7	0.3020	0.599
380.0	0.688	125.0	0.1885	124.3	0.2960	0.603
390.0	0.699	131.0	0.1957	127.0	0.2903	0.608
400.0	0.710	137.1	0.2028	129.6	0.2848	0.612
420.0	0.732	149.5	0.2170	134.8	0.2747	0.621
440.0	0.754	162.0	0.2311	139.8	0.2654	0.630
460.0	0.775	174.7	0.2450	144.7	0.2569	0.639
480.0	0.796	187.5	0.2589	149.6	0.2490	0.648
500.0	0.817	200.6	0.2726	154.3	0.2417	0.657
520.0	0.838	213.8	0.2863	159.0	0.2349	0.666
540.0	0.859	227.2	0.2998	163.7	0.2285	0.675
560.0	0.880	240.8	0.3133	168.3	0.2226	0.684
580.0	0.900	254.6	0.3266	172.8	0.2169	0.693
600.0	0.920	268.5	0.3399	177.3	0.2116	0.701

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

220 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1790)					
199.37	0.03439	-89.8	-0.1157	309.	22.02	0.716
199.37	0.3922	18.5	0.0431	55.8	0.6358	0.606
200.0	0.3933	18.9	0.0437	56.2	0.6329	0.605
210.0	0.4101	24.9	0.0527	61.7	0.5917	0.591
220.0	0.4258	30.8	0.0614	66.6	0.5577	0.582
230.0	0.4406	36.6	0.0699	71.3	0.5291	0.577
240.0	0.4547	42.3	0.0782	75.6	0.5045	0.573
250.0	0.4683	48.0	0.0863	79.7	0.4830	0.572
260.0	0.4813	53.7	0.0943	83.6	0.4641	0.571
270.0	0.4940	59.5	0.1022	87.3	0.4472	0.572
280.0	0.5064	65.2	0.1100	90.8	0.4320	0.573
290.0	0.5185	70.9	0.1177	94.3	0.4182	0.575
300.0	0.5303	76.7	0.1253	97.6	0.4057	0.578
310.0	0.5419	82.5	0.1329	100.9	0.3941	0.581
320.0	0.5533	88.3	0.1404	104.0	0.3835	0.584
330.0	0.5645	94.2	0.1479	107.1	0.3737	0.587
340.0	0.5755	100.1	0.1553	110.1	0.3645	0.591
350.0	0.5864	106.0	0.1626	113.1	0.3559	0.594
360.0	0.5972	112.0	0.1700	115.9	0.3478	0.598
370.0	0.608	118.0	0.1773	118.8	0.3403	0.602
380.0	0.618	124.0	0.1845	121.6	0.3331	0.606
390.0	0.629	130.1	0.1917	124.3	0.3264	0.611
400.0	0.639	136.2	0.1989	127.0	0.3200	0.615
420.0	0.660	148.6	0.2131	132.4	0.3081	0.624
440.0	0.680	161.2	0.2272	137.5	0.2973	0.632
460.0	0.700	173.9	0.2412	142.6	0.2874	0.641
480.0	0.719	186.8	0.2551	147.6	0.2783	0.650
500.0	0.739	199.9	0.2689	152.5	0.2699	0.659
520.0	0.758	213.2	0.2826	157.3	0.2620	0.668
540.0	0.777	226.6	0.2961	162.1	0.2547	0.677
560.0	0.796	240.2	0.3096	166.8	0.2479	0.685
580.0	0.815	254.0	0.3230	171.4	0.2415	0.694
600.0	0.833	267.9	0.3363	176.0	0.2354	0.702

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

240 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.1741)				
207.26	0.03506	-83.8	-0.1071	272.	20.71	0.734
207.26	0.3546	20.5	0.0441	52.6	0.7174	0.630
210.0	0.3593	22.3	0.0467	54.3	0.7025	0.624
220.0	0.3753	28.4	0.0558	60.0	0.6550	0.607
230.0	0.3902	34.4	0.0646	65.2	0.6161	0.596
240.0	0.4042	40.3	0.0731	70.0	0.5835	0.589
250.0	0.4175	46.2	0.0814	74.5	0.5556	0.585
260.0	0.4303	52.1	0.0896	78.7	0.5314	0.583
270.0	0.4426	57.9	0.0976	82.7	0.5100	0.582
280.0	0.4545	63.7	0.1055	86.5	0.4911	0.582
290.0	0.4661	69.5	0.1134	90.2	0.4740	0.583
300.0	0.4774	75.4	0.1211	93.7	0.4586	0.584
310.0	0.4884	81.2	0.1288	97.2	0.4446	0.586
320.0	0.4992	87.1	0.1363	100.5	0.4318	0.589
330.0	0.5099	93.0	0.1439	103.7	0.4199	0.592
340.0	0.5203	98.9	0.1513	106.9	0.4090	0.595
350.0	0.5306	104.9	0.1588	109.9	0.3988	0.599
360.0	0.5408	110.9	0.1661	113.0	0.3892	0.602
370.0	0.5508	117.0	0.1735	115.9	0.3803	0.606
380.0	0.5607	123.0	0.1807	118.8	0.3719	0.610
390.0	0.5705	129.1	0.1880	121.7	0.3640	0.614
400.0	0.5802	135.3	0.1952	124.5	0.3566	0.618
420.0	0.5993	147.7	0.2095	130.0	0.3428	0.626
440.0	0.618	160.4	0.2237	135.3	0.3303	0.635
460.0	0.637	173.1	0.2377	140.5	0.3189	0.643
480.0	0.655	186.1	0.2516	145.6	0.3084	0.652
500.0	0.673	199.2	0.2654	150.7	0.2988	0.661
520.0	0.691	212.5	0.2791	155.6	0.2899	0.669
540.0	0.709	226.0	0.2928	160.5	0.2816	0.678
560.0	0.726	239.6	0.3063	165.2	0.2738	0.687
580.0	0.744	253.4	0.3197	170.0	0.2666	0.695
600.0	0.761	267.4	0.3330	174.6	0.2597	0.703

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

260 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1696)					
214.68	0.03575	-78.0	-0.0990	239.	19.49	0.754
214.68	0.3224	22.3	0.0449	49.4	0.8045	0.655
220.0	0.3312	25.8	0.0500	52.8	0.7705	0.641
230.0	0.3465	32.1	0.0592	58.7	0.7169	0.621
240.0	0.3607	38.2	0.0680	64.1	0.6733	0.609
250.0	0.3740	44.3	0.0766	69.0	0.6369	0.601
260.0	0.3866	50.3	0.0850	73.6	0.6059	0.596
270.0	0.3986	56.2	0.0932	78.0	0.5790	0.593
280.0	0.4103	62.1	0.1013	82.1	0.5553	0.591
290.0	0.4215	68.0	0.1092	86.0	0.5344	0.591
300.0	0.4324	74.0	0.1171	89.8	0.5156	0.592
310.0	0.4430	79.9	0.1248	93.4	0.4986	0.593
320.0	0.4534	85.8	0.1325	96.9	0.4831	0.595
330.0	0.4635	91.8	0.1401	100.3	0.4690	0.597
340.0	0.4735	97.8	0.1476	103.6	0.4559	0.600
350.0	0.4833	103.8	0.1551	106.8	0.4439	0.603
360.0	0.4929	109.8	0.1625	109.9	0.4327	0.606
370.0	0.5024	115.9	0.1699	113.0	0.4222	0.610
380.0	0.5118	122.0	0.1772	116.0	0.4125	0.613
390.0	0.5211	128.2	0.1845	119.0	0.4033	0.617
400.0	0.5303	134.4	0.1917	121.9	0.3946	0.621
420.0	0.5483	146.9	0.2061	127.6	0.3787	0.629
440.0	0.5660	159.5	0.2203	133.1	0.3644	0.637
460.0	0.5834	172.4	0.2344	138.4	0.3514	0.645
480.0	0.601	185.3	0.2484	143.7	0.3395	0.654
500.0	0.618	198.5	0.2622	148.8	0.3286	0.662
520.0	0.634	211.8	0.2760	153.9	0.3185	0.671
540.0	0.651	225.3	0.2896	158.9	0.3091	0.679
560.0	0.667	239.0	0.3031	163.7	0.3004	0.688
580.0	0.684	252.8	0.3166	168.6	0.2922	0.696
600.0	0.700	266.8	0.3299	173.3	0.2845	0.705

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

280 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.1652)				
221.68	0.03646	-72.4	-0.0913	209.	18.35	0.775
221.68	0.2945	23.9	0.0455	46.1	0.8977	0.683
230.0	0.3079	29.5	0.0537	51.8	0.8361	0.656
240.0	0.3225	35.9	0.0629	57.9	0.7769	0.634
250.0	0.3360	42.2	0.0718	63.4	0.7290	0.621
260.0	0.3486	48.4	0.0805	68.4	0.6890	0.612
270.0	0.3606	54.4	0.0889	73.1	0.6550	0.606
280.0	0.3720	60.5	0.0971	77.5	0.6256	0.603
290.0	0.3830	66.5	0.1052	81.7	0.5998	0.601
300.0	0.3936	72.5	0.1131	85.7	0.5769	0.600
310.0	0.4039	78.5	0.1210	89.6	0.5564	0.600
320.0	0.4139	84.5	0.1287	93.3	0.5378	0.601
330.0	0.4237	90.6	0.1364	96.8	0.5210	0.603
340.0	0.4332	96.6	0.1440	100.3	0.5056	0.605
350.0	0.4426	102.7	0.1516	103.6	0.4915	0.608
360.0	0.4519	108.8	0.1590	106.9	0.4784	0.610
370.0	0.4609	114.9	0.1665	110.1	0.4662	0.614
380.0	0.4699	121.0	0.1738	113.2	0.4548	0.617
390.0	0.4787	127.2	0.1811	116.3	0.4442	0.620
400.0	0.4874	133.4	0.1884	119.3	0.4343	0.624
420.0	0.5045	146.0	0.2029	125.2	0.4160	0.631
440.0	0.5213	158.7	0.2171	130.8	0.3997	0.639
460.0	0.5378	171.6	0.2313	136.4	0.3849	0.647
480.0	0.5540	184.6	0.2453	141.8	0.3714	0.656
500.0	0.5700	197.8	0.2592	147.0	0.3591	0.664
520.0	0.5858	211.1	0.2730	152.2	0.3478	0.672
540.0	0.6014	224.7	0.2866	157.3	0.3373	0.681
560.0	0.6168	238.4	0.3002	162.2	0.3275	0.689
580.0	0.6321	252.2	0.3137	167.2	0.3184	0.697
600.0	0.6473	266.3	0.3270	172.0	0.3099	0.706

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

300 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1611)					
228.31	0.03720	-67.0	-0.0839	182.	17.27	0.798
228.31	0.2700	25.3	0.0460	42.9	0.9976	0.714
230.0	0.2729	26.5	0.0478	44.2	0.9811	0.705
240.0	0.2884	33.4	0.0577	51.2	0.8986	0.669
250.0	0.3023	39.9	0.0670	57.3	0.8345	0.646
260.0	0.3152	46.3	0.0759	62.9	0.7826	0.631
270.0	0.3272	52.6	0.0846	68.1	0.7394	0.622
280.0	0.3385	58.8	0.0930	72.8	0.7027	0.616
290.0	0.3493	64.9	0.1012	77.3	0.6709	0.612
300.0	0.3597	71.0	0.1093	81.6	0.6431	0.609
310.0	0.3698	77.1	0.1173	85.7	0.6184	0.608
320.0	0.3795	83.2	0.1251	89.6	0.5963	0.609
330.0	0.3890	89.3	0.1329	93.3	0.5764	0.609
340.0	0.3982	95.4	0.1406	96.9	0.5582	0.611
350.0	0.4073	101.5	0.1482	100.5	0.5416	0.613
360.0	0.4162	107.6	0.1557	103.9	0.5264	0.615
370.0	0.4249	113.8	0.1632	107.2	0.5123	0.618
380.0	0.4334	120.0	0.1706	110.4	0.4992	0.621
390.0	0.4419	126.2	0.1780	113.6	0.4870	0.624
400.0	0.4502	132.5	0.1853	116.7	0.4755	0.627
420.0	0.4665	145.1	0.1998	122.8	0.4547	0.634
440.0	0.4825	157.9	0.2141	128.6	0.4362	0.642
460.0	0.4982	170.8	0.2283	134.3	0.4195	0.650
480.0	0.5136	183.8	0.2424	139.8	0.4043	0.658
500.0	0.5287	197.1	0.2563	145.2	0.3905	0.666
520.0	0.5437	210.5	0.2701	150.5	0.3778	0.674
540.0	0.5584	224.0	0.2838	155.7	0.3661	0.682
560.0	0.5730	237.8	0.2974	160.8	0.3553	0.691
580.0	0.5875	251.6	0.3109	165.8	0.3452	0.699
600.0	0.6018	265.7	0.3243	170.7	0.3357	0.707

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

320 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1572)					
234.61	0.03798	-61.8	-0.0768	158.	16.24	0.825
234.61	0.2483	26.5	0.0464	39.6	1.1050	0.749
240.0	0.2572	30.4	0.0521	43.9	1.0454	0.718
250.0	0.2719	37.4	0.0620	50.9	0.9575	0.679
260.0	0.2852	44.1	0.0713	57.2	0.8892	0.656
270.0	0.2974	50.6	0.0802	62.8	0.8340	0.641
280.0	0.3088	56.9	0.0889	68.0	0.7880	0.631
290.0	0.3196	63.2	0.0973	72.8	0.7488	0.624
300.0	0.3299	69.4	0.1056	77.4	0.7149	0.620
310.0	0.3398	75.6	0.1137	81.7	0.6852	0.618
320.0	0.3493	81.8	0.1216	85.8	0.6589	0.616
330.0	0.3585	88.0	0.1295	89.8	0.6353	0.616
340.0	0.3675	94.1	0.1372	93.6	0.6140	0.617
350.0	0.3763	100.3	0.1449	97.3	0.5946	0.618
360.0	0.3849	106.5	0.1525	100.8	0.5769	0.620
370.0	0.3933	112.7	0.1601	104.3	0.5606	0.622
380.0	0.4015	119.0	0.1675	107.6	0.5456	0.625
390.0	0.4096	125.2	0.1749	110.9	0.5316	0.628
400.0	0.4176	131.5	0.1823	114.1	0.5185	0.631
420.0	0.4333	144.2	0.1969	120.4	0.4949	0.637
440.0	0.4486	157.0	0.2113	126.4	0.4739	0.644
460.0	0.4635	170.0	0.2255	132.2	0.4552	0.652
480.0	0.4782	183.1	0.2396	137.9	0.4382	0.660
500.0	0.4926	196.4	0.2536	143.4	0.4228	0.668
520.0	0.5068	209.8	0.2675	148.8	0.4087	0.676
540.0	0.5209	223.4	0.2812	154.1	0.3957	0.684
560.0	0.5347	237.1	0.2948	159.3	0.3837	0.692
580.0	0.5485	251.0	0.3083	164.4	0.3725	0.700
600.0	0.5620	265.1	0.3217	169.4	0.3621	0.708

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

340 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1534)					
240.61	0.03880	-56.7	-0.0699	135.	15.27	0.855
240.61	0.2288	27.5	0.0466	36.3	1.2211	0.790
250.0	0.2440	34.6	0.0566	44.0	1.1045	0.727
260.0	0.2580	41.7	0.0665	51.1	1.0126	0.688
270.0	0.2706	48.4	0.0758	57.3	0.9409	0.665
280.0	0.2822	55.0	0.0848	63.0	0.8829	0.649
290.0	0.2930	61.4	0.0934	68.2	0.8344	0.639
300.0	0.3033	67.8	0.1019	73.1	0.7931	0.632
310.0	0.3131	74.1	0.1101	77.7	0.7574	0.628
320.0	0.3225	80.4	0.1182	82.0	0.7260	0.625
330.0	0.3315	86.6	0.1262	86.2	0.6982	0.624
340.0	0.3403	92.9	0.1340	90.2	0.6732	0.624
350.0	0.3488	99.1	0.1418	94.0	0.6507	0.624
360.0	0.3572	105.3	0.1494	97.7	0.6302	0.625
370.0	0.3653	111.6	0.1570	101.3	0.6114	0.627
380.0	0.3733	117.9	0.1646	104.8	0.5942	0.629
390.0	0.3811	124.2	0.1720	108.2	0.5782	0.632
400.0	0.3889	130.5	0.1794	111.6	0.5634	0.634
420.0	0.4039	143.3	0.1941	118.0	0.5366	0.640
440.0	0.4186	156.2	0.2086	124.2	0.5130	0.647
460.0	0.4329	169.2	0.2229	130.2	0.4920	0.654
480.0	0.4470	182.3	0.2370	136.0	0.4731	0.662
500.0	0.4608	195.6	0.2510	141.6	0.4560	0.670
520.0	0.4744	209.1	0.2649	147.2	0.4403	0.677
540.0	0.4877	222.7	0.2787	152.6	0.4260	0.685
560.0	0.5010	236.5	0.2923	157.8	0.4127	0.693
580.0	0.5140	250.5	0.3059	163.0	0.4004	0.701
600.0	0.5269	264.6	0.3193	168.1	0.3890	0.709

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

360 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1497)					
246.35	0.03968	-51.6	-0.0632	115.	14.33	0.892
246.35	0.2112	28.3	0.0466	33.0	1.347	0.838
250.0	0.2175	31.3	0.0508	36.4	1.287	0.799
260.0	0.2329	38.9	0.0615	44.6	1.158	0.733
270.0	0.2461	46.1	0.0713	51.6	1.064	0.695
280.0	0.2581	52.9	0.0806	57.8	0.9895	0.672
290.0	0.2691	59.6	0.0895	63.5	0.9292	0.657
300.0	0.2794	66.1	0.0982	68.7	0.8787	0.646
310.0	0.2891	72.5	0.1066	73.6	0.8356	0.640
320.0	0.2984	78.9	0.1148	78.2	0.7983	0.635
330.0	0.3074	85.2	0.1229	82.6	0.7654	0.632
340.0	0.3160	91.5	0.1308	86.8	0.7362	0.631
350.0	0.3243	97.8	0.1387	90.8	0.7100	0.631
360.0	0.3325	104.2	0.1464	94.7	0.6864	0.631
370.0	0.3404	110.5	0.1541	98.4	0.6648	0.632
380.0	0.3482	116.8	0.1617	102.0	0.6451	0.634
390.0	0.3558	123.2	0.1692	105.5	0.6269	0.636
400.0	0.3632	129.5	0.1766	109.0	0.6101	0.638
420.0	0.3778	142.4	0.1914	115.6	0.5799	0.644
440.0	0.3919	155.3	0.2059	122.0	0.5535	0.650
460.0	0.4057	168.4	0.2203	128.1	0.5300	0.657
480.0	0.4192	181.6	0.2345	134.1	0.5090	0.664
500.0	0.4325	194.9	0.2485	139.9	0.4901	0.672
520.0	0.4455	208.4	0.2625	145.5	0.4728	0.679
540.0	0.4583	222.1	0.2763	151.0	0.4570	0.687
560.0	0.4709	235.9	0.2900	156.4	0.4424	0.695
580.0	0.4834	249.9	0.3035	161.7	0.4290	0.703
600.0	0.4958	264.0	0.3170	166.9	0.4164	0.711

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

380 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1460)					
251.83	0.04063	-46.7	-0.0567	96.	13.43	0.936
251.83	0.1951	28.9	0.0464	29.6	1.485	0.896
260.0	0.2091	35.8	0.0560	37.4	1.336	0.798
270.0	0.2234	43.5	0.0666	45.4	1.207	0.736
280.0	0.2360	50.6	0.0763	52.3	1.111	0.701
290.0	0.2473	57.5	0.0856	58.5	1.035	0.678
300.0	0.2577	64.2	0.0945	64.2	0.9728	0.663
310.0	0.2675	70.8	0.1031	69.4	0.9208	0.653
320.0	0.2768	77.3	0.1115	74.3	0.8762	0.646
330.0	0.2856	83.8	0.1197	78.9	0.8375	0.642
340.0	0.2941	90.2	0.1277	83.3	0.8034	0.639
350.0	0.3023	96.6	0.1357	87.5	0.7730	0.638
360.0	0.3103	102.9	0.1435	91.5	0.7457	0.637
370.0	0.3181	109.3	0.1512	95.4	0.7210	0.638
380.0	0.3256	115.7	0.1589	99.2	0.6985	0.639
390.0	0.3330	122.1	0.1664	102.9	0.6779	0.640
400.0	0.3403	128.5	0.1740	106.4	0.6589	0.642
420.0	0.3544	141.4	0.1888	113.3	0.6249	0.647
440.0	0.3681	154.4	0.2034	119.8	0.5954	0.653
460.0	0.3814	167.5	0.2178	126.1	0.5693	0.659
480.0	0.3944	180.8	0.2321	132.2	0.5460	0.666
500.0	0.4071	194.2	0.2462	138.1	0.5251	0.674
520.0	0.4196	207.7	0.2601	143.9	0.5061	0.681
540.0	0.4319	221.4	0.2740	149.5	0.4887	0.689
560.0	0.4441	235.3	0.2877	155.0	0.4728	0.696
580.0	0.4560	249.3	0.3013	160.4	0.4581	0.704
600.0	0.4679	263.4	0.3148	165.6	0.4444	0.712

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

400 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1424)					
257.09	0.04167	-41.8	-0.0503	79.	12.56	0.990
257.09	0.1802	29.3	0.0460	26.2	1.636	0.969
260.0	0.1858	32.1	0.0498	29.5	1.563	0.909
270.0	0.2020	40.5	0.0614	38.9	1.378	0.794
280.0	0.2154	48.2	0.0718	46.6	1.250	0.738
290.0	0.2272	55.4	0.0815	53.4	1.154	0.704
300.0	0.2379	62.3	0.0907	59.5	1.077	0.683
310.0	0.2478	69.1	0.0995	65.1	1.014	0.669
320.0	0.2571	75.7	0.1081	70.3	0.9607	0.659
330.0	0.2659	82.3	0.1165	75.2	0.9149	0.653
340.0	0.2743	88.8	0.1247	79.8	0.8750	0.648
350.0	0.2825	95.2	0.1327	84.2	0.8398	0.646
360.0	0.2903	101.7	0.1406	88.4	0.8084	0.644
370.0	0.2979	108.1	0.1484	92.5	0.7802	0.644
380.0	0.3053	114.6	0.1561	96.4	0.7546	0.644
390.0	0.3125	121.0	0.1638	100.2	0.7312	0.645
400.0	0.3196	127.5	0.1713	103.8	0.7098	0.647
420.0	0.3333	140.5	0.1862	110.9	0.6717	0.651
440.0	0.3466	153.5	0.2009	117.6	0.6387	0.656
460.0	0.3595	166.7	0.2154	124.1	0.6098	0.662
480.0	0.3720	180.0	0.2297	130.3	0.5841	0.669
500.0	0.3843	193.4	0.2439	136.4	0.5611	0.676
520.0	0.3964	207.0	0.2579	142.2	0.5402	0.683
540.0	0.4082	220.8	0.2718	148.0	0.5212	0.690
560.0	0.4199	234.6	0.2855	153.6	0.5038	0.698
580.0	0.4314	248.7	0.2991	159.0	0.4878	0.705
600.0	0.4428	262.8	0.3126	164.4	0.4730	0.713

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

420 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID	(X=.1388)				
262.13	0.04283	-36.8	-0.0439	64.	11.71	1.061
262.13	0.1664	29.5	0.0453	22.9	1.805	1.063
270.0	0.1812	37.1	0.0557	31.6	1.592	0.886
280.0	0.1960	45.4	0.0671	40.6	1.415	0.789
290.0	0.2085	53.0	0.0773	48.1	1.290	0.738
300.0	0.2196	60.2	0.0869	54.7	1.193	0.707
310.0	0.2297	67.2	0.0960	60.7	1.116	0.687
320.0	0.2391	74.0	0.1048	66.3	1.052	0.674
330.0	0.2479	80.7	0.1133	71.4	0.9984	0.664
340.0	0.2563	87.3	0.1216	76.3	0.9517	0.658
350.0	0.2644	93.9	0.1298	80.9	0.9109	0.654
360.0	0.2721	100.4	0.1378	85.3	0.8748	0.652
370.0	0.2796	106.9	0.1457	89.5	0.8425	0.650
380.0	0.2869	113.4	0.1535	93.6	0.8135	0.650
390.0	0.2939	119.9	0.1612	97.5	0.7870	0.650
400.0	0.3008	126.4	0.1688	101.3	0.7629	0.651
420.0	0.3142	139.5	0.1838	108.5	0.7203	0.655
440.0	0.3271	152.6	0.1986	115.5	0.6836	0.659
460.0	0.3396	165.9	0.2131	122.1	0.6516	0.665
480.0	0.3518	179.2	0.2275	128.5	0.6233	0.671
500.0	0.3637	192.7	0.2417	134.6	0.5980	0.678
520.0	0.3753	206.3	0.2557	140.6	0.5752	0.685
540.0	0.3868	220.1	0.2696	146.5	0.5545	0.692
560.0	0.3980	234.0	0.2834	152.2	0.5356	0.699
580.0	0.4091	248.1	0.2970	157.7	0.5182	0.707
600.0	0.4200	262.3	0.3106	163.2	0.5021	0.714

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

440 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1351)					
266.97	0.04413	-31.9	-0.0375	50.	10.67	1.157
266.97	0.1533	29.4	0.0443	19.4	1.995	1.189
270.0	0.1601	32.8	0.0490	23.4	1.876	1.058
280.0	0.1773	42.2	0.0618	34.0	1.614	0.864
290.0	0.1909	50.4	0.0729	42.5	1.447	0.782
300.0	0.2025	58.0	0.0829	49.8	1.325	0.737
310.0	0.2130	65.2	0.0924	56.2	1.230	0.709
320.0	0.2225	72.2	0.1014	62.2	1.153	0.691
330.0	0.2314	79.1	0.1101	67.6	1.089	0.678
340.0	0.2398	85.8	0.1186	72.7	1.034	0.669
350.0	0.2478	92.5	0.1269	77.6	0.9867	0.663
360.0	0.2555	99.1	0.1350	82.1	0.9452	0.660
370.0	0.2629	105.7	0.1430	86.5	0.9084	0.657
380.0	0.2700	112.3	0.1508	90.7	0.8753	0.656
390.0	0.2770	118.8	0.1586	94.8	0.8455	0.656
400.0	0.2838	125.4	0.1663	98.7	0.8184	0.656
420.0	0.2968	138.5	0.1814	106.2	0.7708	0.658
440.0	0.3094	151.7	0.1962	113.3	0.7301	0.663
460.0	0.3216	165.0	0.2109	120.1	0.6948	0.668
480.0	0.3334	178.4	0.2253	126.6	0.6636	0.674
500.0	0.3449	192.0	0.2395	132.9	0.6360	0.680
520.0	0.3562	205.6	0.2536	139.0	0.6111	0.687
540.0	0.3673	219.4	0.2676	145.0	0.5886	0.694
560.0	0.3782	233.4	0.2814	150.8	0.5680	0.701
580.0	0.3889	247.5	0.2950	156.5	0.5492	0.708
600.0	0.3994	261.7	0.3086	162.0	0.5318	0.716

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

460 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1313)					
271.62	0.04565	-26.8	-0.0311	38.	10.04	1.296
271.62	0.1409	28.9	0.0429	16.0	2.213	1.368
280.0	0.1588	38.4	0.0559	26.9	1.867	0.988
290.0	0.1741	47.5	0.0681	36.6	1.632	0.844
300.0	0.1865	55.6	0.0788	44.6	1.474	0.775
310.0	0.1974	63.1	0.0886	51.6	1.356	0.736
320.0	0.2072	70.4	0.0980	58.0	1.263	0.710
330.0	0.2162	77.4	0.1069	63.8	1.187	0.694
340.0	0.2246	84.3	0.1156	69.1	1.122	0.682
350.0	0.2326	91.0	0.1240	74.2	1.068	0.674
360.0	0.2403	97.7	0.1322	79.0	1.020	0.668
370.0	0.2476	104.4	0.1403	83.5	0.9779	0.665
380.0	0.2546	111.1	0.1483	87.9	0.9405	0.663
390.0	0.2615	117.7	0.1561	92.1	0.9069	0.661
400.0	0.2681	124.3	0.1638	96.1	0.8764	0.661
420.0	0.2810	137.5	0.1791	103.9	0.8233	0.663
440.0	0.2932	150.8	0.1940	111.2	0.7782	0.666
460.0	0.3051	164.2	0.2087	118.1	0.7393	0.671
480.0	0.3166	177.6	0.2232	124.8	0.7052	0.676
500.0	0.3278	191.2	0.2374	131.2	0.6749	0.682
520.0	0.3388	204.9	0.2516	137.5	0.6479	0.689
540.0	0.3495	218.8	0.2656	143.5	0.6234	0.695
560.0	0.3600	232.7	0.2794	149.4	0.6012	0.702
580.0	0.3704	246.9	0.2931	155.2	0.5808	0.710
600.0	0.3806	261.1	0.3067	160.8	0.5621	0.717

480 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1272)					
276.07	0.04749	-21.6	-0.0245	27.	9.20	1.515
276.07	0.1287	28.0	0.0410	12.6	2.470	1.646
280.0	0.1393	33.6	0.0485	18.7	2.217	1.245
290.0	0.1576	44.1	0.0628	30.3	1.859	0.936
300.0	0.1713	52.9	0.0744	39.3	1.648	0.826
310.0	0.1827	60.9	0.0848	46.9	1.498	0.769
320.0	0.1928	68.4	0.0945	53.7	1.384	0.734
330.0	0.2020	75.6	0.1037	59.9	1.293	0.711
340.0	0.2106	82.6	0.1125	65.5	1.218	0.696
350.0	0.2186	89.5	0.1211	70.8	1.154	0.685
360.0	0.2262	96.4	0.1295	75.8	1.099	0.678
370.0	0.2335	103.1	0.1377	80.6	1.051	0.673
380.0	0.2405	109.8	0.1457	85.1	1.009	0.670
390.0	0.2472	116.5	0.1536	89.4	0.9712	0.668
400.0	0.2538	123.2	0.1614	93.6	0.9371	0.667
420.0	0.2664	136.5	0.1768	101.5	0.8779	0.667
440.0	0.2784	149.9	0.1918	109.0	0.8281	0.670
460.0	0.2900	163.3	0.2065	116.2	0.7853	0.674
480.0	0.3012	176.8	0.2211	123.0	0.7480	0.679
500.0	0.3121	190.5	0.2354	129.6	0.7150	0.684
520.0	0.3228	204.2	0.2496	135.9	0.6856	0.691
540.0	0.3332	218.1	0.2636	142.1	0.6591	0.697
560.0	0.3434	232.1	0.2775	148.1	0.6350	0.704
580.0	0.3534	246.2	0.2912	153.9	0.6131	0.711
600.0	0.3633	260.5	0.3049	159.7	0.5929	0.718

TABLE 5A (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE VAPOR

500 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
COEXISTING	LIQUID (X=.1213)					
280.33	0.05001	-15.7	-0.0171	17.	8.28	1.956
280.33	0.1165	26.5	0.0383	9.2	2.785	2.133
290.0	0.1410	40.1	0.0566	23.5	2.150	1.092
300.0	0.1566	49.9	0.0696	33.7	1.853	0.896
310.0	0.1688	58.4	0.0807	42.1	1.660	0.810
320.0	0.1794	66.2	0.0908	49.4	1.520	0.762
330.0	0.1889	73.7	0.1004	55.9	1.410	0.732
340.0	0.1975	80.9	0.1094	61.9	1.321	0.712
350.0	0.2056	88.0	0.1182	67.4	1.247	0.698
360.0	0.2132	94.9	0.1267	72.7	1.184	0.689
370.0	0.2205	101.8	0.1350	77.6	1.129	0.682
380.0	0.2274	108.6	0.1432	82.3	1.081	0.677
390.0	0.2341	115.3	0.1512	86.8	1.039	0.674
400.0	0.2406	122.1	0.1591	91.1	1.0006	0.672
420.0	0.2530	135.5	0.1745	99.2	0.9348	0.672
440.0	0.2648	149.0	0.1896	106.9	0.8797	0.673
460.0	0.2761	162.5	0.2045	114.2	0.8328	0.677
480.0	0.2871	176.0	0.2191	121.2	0.7920	0.681
500.0	0.2977	189.7	0.2335	127.9	0.7561	0.687
520.0	0.3080	203.5	0.2477	134.4	0.7242	0.693
540.0	0.3182	217.4	0.2617	140.7	0.6955	0.699
560.0	0.3281	231.5	0.2757	146.8	0.6696	0.706
580.0	0.3379	245.6	0.2894	152.7	0.6460	0.713
600.0	0.3475	260.0	0.3031	158.5	0.6244	0.720

520 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
290.0	0.12324	34.8	0.0489	15.9	2.56	1.424
300.0	0.14207	46.4	0.0643	27.8	2.10	1.001
310.0	0.15556	55.7	0.0764	37.1	1.85	0.865
320.0	0.16671	64.0	0.0871	44.9	1.67	0.797
330.0	0.17648	71.7	0.0970	51.9	1.54	0.757
340.0	0.18532	79.2	0.1063	58.2	1.43	0.730
350.0	0.19349	86.4	0.1153	64.0	1.35	0.713
360.0	0.2011	93.4	0.1240	69.5	1.27	0.700
370.0	0.2084	100.4	0.1324	74.6	1.21	0.691
380.0	0.2153	107.3	0.1407	79.5	1.16	0.685
390.0	0.2219	114.1	0.1488	84.1	1.11	0.681
400.0	0.2283	120.9	0.1567	88.6	1.07	0.679
420.0	0.2406	134.5	0.1723	97.0	0.994	0.677
440.0	0.2522	148.0	0.1875	104.9	0.933	0.677
460.0	0.2633	161.6	0.2024	112.3	0.882	0.680
480.0	0.2740	175.2	0.2171	119.4	0.837	0.684
500.0	0.2844	188.9	0.2315	126.	0.798	0.689
520.0	0.2945	202.8	0.2458	133.	0.764	0.695
540.0	0.3043	216.7	0.2599	139.	0.733	0.701
560.0	0.3140	230.8	0.2739	145.	0.705	0.707
580.0	0.3235	245.0	0.2877	152.	0.680	0.714
600.0	0.3328	259.4	0.3013	157.	0.656	0.721

TABLE 5B. THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS IN THE LIQUID.

5 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02543	-224.4	-0.3720	1890.	65.8	0.495
-30.55	0.02564	-219.7	-0.3609	1818.	64.1	0.502
COEXISTING VAPOR (X=.0196)						
-30.55	15.508	-49.2	0.0238	76.2	0.0120	0.335

10 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02543	-224.4	-0.3720	1892.	65.9	0.495
-30.0	0.02565	-219.4	-0.3603	1817.	64.0	0.502
-20.0	0.02589	-214.3	-0.3487	1739.	62.1	0.509
-10.0	0.02613	-209.2	-0.3372	1659.	60.2	0.515
-2.82	0.02631	-205.5	-0.3291	1602.	58.7	0.519
COEXISTING VAPOR (X=.0230)						
-2.82	8.149	-40.6	0.0207	79.0	0.0232	0.354

14.696 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02542	-224.4	-0.3721	1894.	65.9	0.495
-30.0	0.02565	-219.4	-0.3603	1819.	64.1	0.502
-20.0	0.02589	-214.3	-0.3487	1741.	62.2	0.509
-10.0	0.02613	-209.2	-0.3373	1661.	60.2	0.515
0.0	0.02638	-204.0	-0.3259	1581.	58.2	0.521
10.0	0.02664	-198.8	-0.3147	1501.	56.2	0.526
14.45	0.02676	-196.5	-0.3097	1465.	55.3	0.529
COEXISTING VAPOR (X=.0252)						
14.45	5.694	-35.1	0.0201	80.2	0.0335	0.367

20 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02542	-224.3	-0.3721	1897.	66.0	0.495
-30.0	0.02565	-219.4	-0.3604	1821.	64.1	0.502
-20.0	0.02588	-214.3	-0.3488	1743.	62.2	0.509
-10.0	0.02613	-209.2	-0.3373	1664.	60.3	0.515
0.0	0.02638	-204.0	-0.3259	1583.	58.3	0.521
10.0	0.02664	-198.8	-0.3147	1503.	56.2	0.526
20.0	0.02691	-193.5	-0.3036	1422.	54.2	0.532
29.39	0.02717	-188.5	-0.2933	1347.	52.3	0.538
COEXISTING VAPOR (X=.0271)						
29.39	4.269	-30.4	0.0201	80.9	0.0452	0.379

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

25 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02542	-224.3	-0.3721	1899.	66.1	0.495
-30.0	0.02565	-219.3	-0.3604	1823.	64.2	0.502
-20.0	0.02588	-214.3	-0.3488	1745.	62.3	0.509
-10.0	0.02613	-209.2	-0.3373	1666.	60.3	0.515
0.0	0.02638	-204.0	-0.3260	1586.	58.3	0.521
10.0	0.02664	-198.8	-0.3147	1505.	56.3	0.526
20.0	0.02691	-193.5	-0.3036	1424.	54.3	0.532
30.0	0.02719	-188.2	-0.2926	1344.	52.2	0.539
40.0	0.02748	-182.8	-0.2817	1265.	50.2	0.545
40.88	0.02751	-182.3	-0.2807	1258.	50.0	0.546
COEXISTING	VAPOR (X=.0287)					
40.88	3.462	-26.8	0.0205	81.2	0.0563	0.389

30 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02542	-224.3	-0.3721	1902.	66.1	0.495
-30.0	0.02565	-219.3	-0.3604	1826.	64.3	0.502
-20.0	0.02588	-214.3	-0.3488	1748.	62.3	0.509
-10.0	0.02612	-209.2	-0.3373	1668.	60.4	0.515
0.0	0.02637	-204.0	-0.3260	1588.	58.4	0.521
10.0	0.02663	-198.8	-0.3148	1507.	56.4	0.526
20.0	0.02690	-193.5	-0.3037	1426.	54.3	0.532
30.0	0.02719	-188.2	-0.2926	1346.	52.3	0.539
40.0	0.02748	-182.7	-0.2817	1267.	50.2	0.545
50.0	0.02778	-177.2	-0.2708	1188.	48.22	0.552
50.73	0.02781	-176.8	-0.2700	1182.	48.07	0.553
COEXISTING	VAPOR (X=.0300)					
50.73	2.915	-23.6	0.0211	81.2	0.0676	0.397

40 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02542	-224.3	-0.3722	1906.	66.3	0.495
-30.0	0.02564	-219.3	-0.3604	1830.	64.4	0.502
-20.0	0.02588	-214.2	-0.3488	1752.	62.4	0.509
-10.0	0.02612	-209.1	-0.3374	1672.	60.5	0.515
0.0	0.02637	-204.0	-0.3260	1592.	58.5	0.520
10.0	0.02663	-198.8	-0.3148	1511.	56.4	0.526
20.0	0.02690	-193.5	-0.3037	1430.	54.4	0.532
30.0	0.02718	-188.1	-0.2927	1350.	52.4	0.538
40.0	0.02747	-182.7	-0.2817	1270.	50.4	0.545
50.0	0.02778	-177.2	-0.2709	1192.	48.31	0.552
60.0	0.02810	-171.7	-0.2601	1115.	46.29	0.559
67.17	0.02834	-167.6	-0.2524	1060.	44.84	0.565
COEXISTING	VAPOR (X=.0323)					
67.17	2.219	-18.4	0.0224	80.8	0.0905	0.412

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

50 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02541	-224.2	-0.3722	1911.	66.4	0.495
-30.0	0.02564	-219.3	-0.3605	1835.	64.5	0.502
-20.0	0.02587	-214.2	-0.3489	1757.	62.6	0.509
-10.0	0.02612	-209.1	-0.3374	1677.	60.6	0.515
0.0	0.02637	-203.9	-0.3261	1596.	58.6	0.520
10.0	0.02662	-198.7	-0.3149	1515.	56.6	0.526
20.0	0.02689	-193.5	-0.3038	1434.	54.5	0.532
30.0	0.02717	-188.1	-0.2928	1354.	52.5	0.538
40.0	0.02747	-182.7	-0.2818	1274.	50.4	0.545
50.0	0.02777	-177.2	-0.2709	1196.	48.40	0.552
60.0	0.02809	-171.6	-0.2601	1119.	46.37	0.559
70.0	0.02843	-166.0	-0.2494	1043.	44.36	0.567
80.0	0.02878	-160.3	-0.2387	968.	42.35	0.575
80.74	0.02881	-159.8	-0.2379	963.	42.20	0.576
COEXISTING VAPOR (X=.0342)						
80.74	1.792	-14.1	0.0237	80.0	0.1141	0.426

60 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02541	-224.2	-0.3722	1916.	66.5	0.495
-30.0	0.02564	-219.2	-0.3605	1840.	64.6	0.502
-20.0	0.02587	-214.2	-0.3489	1761.	62.7	0.509
-10.0	0.02611	-209.1	-0.3375	1681.	60.7	0.515
0.0	0.02636	-203.9	-0.3261	1600.	58.7	0.520
10.0	0.02662	-198.7	-0.3149	1519.	56.6	0.526
20.0	0.02689	-193.4	-0.3038	1438.	54.6	0.532
30.0	0.02717	-188.1	-0.2928	1358.	52.6	0.538
40.0	0.02746	-182.7	-0.2819	1278.	50.5	0.545
50.0	0.02777	-177.2	-0.2710	1200.	48.49	0.552
60.0	0.02808	-171.6	-0.2602	1122.	46.46	0.559
70.0	0.02842	-166.0	-0.2494	1046.	44.45	0.567
80.0	0.02877	-160.2	-0.2388	972.	42.44	0.575
90.0	0.02914	-154.4	-0.2281	899.	40.45	0.584
92.41	0.02924	-153.0	-0.2255	882.	39.97	0.586
COEXISTING VAPOR (X=.0360)						
92.41	1.502	-10.5	0.0251	79.0	0.1384	0.438

80 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02540	-224.2	-0.3723	1925.	66.8	0.495
-30.0	0.02563	-219.2	-0.3606	1849.	64.9	0.502
-20.0	0.02586	-214.1	-0.3490	1770.	62.9	0.509
-10.0	0.02610	-209.0	-0.3376	1690.	60.9	0.514
0.0	0.02635	-203.9	-0.3262	1609.	58.9	0.520
10.0	0.02661	-198.7	-0.3150	1527.	56.8	0.526
20.0	0.02688	-193.4	-0.3039	1446.	54.8	0.532
30.0	0.02716	-188.0	-0.2929	1366.	52.8	0.538
40.0	0.02745	-182.6	-0.2820	1286.	50.7	0.545
50.0	0.02775	-177.1	-0.2711	1207.	48.7	0.551
60.0	0.02807	-171.6	-0.2603	1130.	46.6	0.559
70.0	0.02840	-165.9	-0.2496	1054.	44.6	0.567
80.0	0.02875	-160.2	-0.2389	980.	42.6	0.575
90.0	0.02912	-154.4	-0.2282	907.	40.6	0.584
100.0	0.02951	-148.5	-0.2176	836.	38.6	0.593
110.0	0.02993	-142.5	-0.2070	766.	36.7	0.603
111.95	0.03002	-141.3	-0.2050	753.	36.3	0.605
COEXISTING VAPOR (X=.0389)						
111.95	1.133	-4.4	0.0277	76.6	0.1891	0.461

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

100 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02540	-224.1	-0.3724	1935.	67.0	0.495
-30.0	0.02562	-219.1	-0.3607	1858.	65.1	0.502
-20.0	0.02585	-214.1	-0.3491	1779.	63.1	0.508
-10.0	0.02609	-209.0	-0.3376	1698.	61.1	0.514
0.0	0.02634	-203.8	-0.3263	1617.	59.1	0.520
10.0	0.02660	-198.6	-0.3151	1535.	57.0	0.526
20.0	0.02687	-193.3	-0.3040	1454.	55.0	0.532
30.0	0.02715	-188.0	-0.2930	1373.	52.9	0.538
40.0	0.02744	-182.6	-0.2821	1294.	50.9	0.544
50.0	0.02774	-177.1	-0.2712	1215.	48.8	0.551
60.0	0.02806	-171.5	-0.2604	1137.	46.8	0.559
70.0	0.02839	-165.9	-0.2497	1061.	44.8	0.566
80.0	0.02874	-160.2	-0.2390	987.	42.8	0.575
90.0	0.02910	-154.4	-0.2284	914.	40.8	0.583
100.0	0.02949	-148.5	-0.2178	843.	38.8	0.593
110.0	0.02991	-142.5	-0.2072	773.	36.9	0.602
120.0	0.03035	-136.4	-0.1966	706.	34.9	0.613
128.14	0.03073	-131.4	-0.1880	652.	33.3	0.622
COEXISTING VAPOR (X=.0415)						
128.14	0.9066	0.5	0.0300	73.9	0.2431	0.482

120 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02539	-224.0	-0.3725	1944.	67.3	0.494
-30.0	0.02561	-219.1	-0.3608	1867.	65.3	0.502
-20.0	0.02585	-214.0	-0.3492	1788.	63.3	0.508
-10.0	0.02609	-208.9	-0.3377	1707.	61.3	0.514
0.0	0.02634	-203.8	-0.3264	1625.	59.3	0.520
10.0	0.02659	-198.5	-0.3152	1544.	57.2	0.526
20.0	0.02686	-193.3	-0.3041	1462.	55.2	0.531
30.0	0.02714	-187.9	-0.2931	1381.	53.1	0.538
40.0	0.02743	-182.5	-0.2822	1301.	51.1	0.544
50.0	0.02773	-177.0	-0.2713	1223.	49.0	0.551
60.0	0.02804	-171.5	-0.2605	1145.	47.0	0.558
70.0	0.02837	-165.9	-0.2498	1069.	45.0	0.566
80.0	0.02872	-160.1	-0.2392	994.	43.0	0.574
90.0	0.02909	-154.4	-0.2285	922.	41.0	0.583
100.0	0.02947	-148.5	-0.2179	850.	39.0	0.592
110.0	0.02988	-142.5	-0.2073	781.	37.0	0.602
120.0	0.03032	-136.4	-0.1968	713.	35.1	0.612
130.0	0.03079	-130.2	-0.1862	647.	33.2	0.624
140.0	0.03130	-123.9	-0.1756	582.	31.2	0.636
142.09	0.03141	-122.6	-0.1734	569.	30.8	0.639
COEXISTING VAPOR (X=.0438)						
142.09	0.7530	4.68	0.0321	71.0	0.3005	0.503

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

140 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02538	-224.0	-0.3726	1954.	67.5	0.494
-30.0	0.02561	-219.0	-0.3609	1876.	65.6	0.502
-20.0	0.02584	-214.0	-0.3493	1796.	63.6	0.508
-10.0	0.02608	-208.9	-0.3378	1715.	61.5	0.514
0.0	0.02633	-203.7	-0.3265	1634.	59.5	0.520
10.0	0.02658	-198.5	-0.3153	1552.	57.4	0.525
20.0	0.02685	-193.2	-0.3042	1470.	55.4	0.531
30.0	0.02713	-187.9	-0.2932	1389.	53.3	0.537
40.0	0.02741	-182.5	-0.2823	1309.	51.3	0.544
50.0	0.02771	-177.0	-0.2714	1230.	49.2	0.551
60.0	0.02803	-171.4	-0.2607	1153.	47.2	0.558
70.0	0.02836	-165.8	-0.2500	1076.	45.1	0.566
80.0	0.02870	-160.1	-0.2393	1002.	43.1	0.574
90.0	0.02907	-154.3	-0.2287	929.	41.1	0.582
100.0	0.02945	-148.4	-0.2181	858.	39.2	0.592
110.0	0.02986	-142.5	-0.2075	788.	37.2	0.601
120.0	0.03030	-136.4	-0.1969	720.	35.3	0.612
130.0	0.03076	-130.2	-0.1864	654.	33.3	0.623
140.0	0.03127	-123.9	-0.1758	590.	31.4	0.635
150.0	0.03181	-117.5	-0.1652	527.	29.5	0.648
154.42	0.03207	-114.6	-0.1604	500.	28.7	0.655
COEXISTING VAPOR (X=.0460)						
154.42	0.6417	8.26	0.0340	68.0	0.3614	0.523

160 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02538	-223.9	-0.3727	1963.	67.8	0.494
-30.0	0.02560	-218.9	-0.3610	1885.	65.8	0.502
-20.0	0.02583	-213.9	-0.3494	1805.	63.8	0.508
-10.0	0.02607	-208.8	-0.3379	1724.	61.8	0.514
0.0	0.02632	-203.6	-0.3266	1642.	59.7	0.520
10.0	0.02657	-198.4	-0.3154	1560.	57.6	0.525
20.0	0.02684	-193.2	-0.3043	1478.	55.6	0.531
30.0	0.02712	-187.8	-0.2933	1397.	53.5	0.537
40.0	0.02740	-182.4	-0.2824	1317.	51.4	0.544
50.0	0.02770	-177.0	-0.2716	1238.	49.4	0.550
60.0	0.02801	-171.4	-0.2608	1160.	47.3	0.558
70.0	0.02834	-165.8	-0.2501	1084.	45.3	0.565
80.0	0.02869	-160.1	-0.2394	1009.	43.3	0.573
90.0	0.02905	-154.3	-0.2288	936.	41.3	0.582
100.0	0.02943	-148.4	-0.2182	865.	39.3	0.591
110.0	0.02984	-142.4	-0.2077	796.	37.4	0.601
120.0	0.03027	-136.4	-0.1971	728.	35.4	0.611
130.0	0.03073	-130.2	-0.1865	662.	33.5	0.622
140.0	0.03123	-123.9	-0.1760	597.	31.6	0.634
150.0	0.03177	-117.5	-0.1654	535.	29.7	0.647
160.0	0.03236	-110.9	-0.1547	474.	27.8	0.662
165.53	0.03271	-107.2	-0.1488	441.	26.8	0.670
COEXISTING VAPOR (X=.0480)						
165.53	0.5570	11.39	0.0357	64.9	0.4261	0.543

TABLE 5B (CONT.). THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

180 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02537	-223.9	-0.3727	1973.	68.0	0.494
-30.0	0.02559	-218.9	-0.3610	1894.	66.0	0.502
-20.0	0.02582	-213.8	-0.3495	1814.	64.0	0.508
-10.0	0.02606	-208.7	-0.3380	1732.	62.0	0.514
0.0	0.02631	-203.6	-0.3267	1650.	59.9	0.519
10.0	0.02656	-198.4	-0.3155	1568.	57.8	0.525
20.0	0.02683	-193.1	-0.3044	1486.	55.7	0.531
30.0	0.02710	-187.8	-0.2934	1405.	53.7	0.537
40.0	0.02739	-182.4	-0.2825	1324.	51.6	0.543
50.0	0.02769	-176.9	-0.2717	1245.	49.6	0.550
60.0	0.02800	-171.4	-0.2609	1167.	47.5	0.557
70.0	0.02833	-165.7	-0.2502	1091.	45.5	0.565
80.0	0.02867	-160.0	-0.2396	1017.	43.5	0.573
90.0	0.02903	-154.3	-0.2289	944.	41.5	0.582
100.0	0.02941	-148.4	-0.2184	872.	39.5	0.591
110.0	0.02982	-142.4	-0.2078	803.	37.6	0.600
120.0	0.03025	-136.4	-0.1973	735.	35.6	0.610
130.0	0.03071	-130.2	-0.1867	669.	33.7	0.621
140.0	0.03120	-123.9	-0.1762	605.	31.8	0.633
150.0	0.03173	-117.5	-0.1656	542.	29.9	0.646
160.0	0.03232	-111.0	-0.1549	481.	28.0	0.660
170.0	0.03296	-104.3	-0.1442	422.	26.1	0.676
175.66	0.03335	-100.4	-0.1381	389.	25.1	0.686
COEXISTING VAPOR (X=.0499)						
175.66	0.4904	14.16	0.0372	61.8	0.4948	0.564

200 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02536	-223.8	-0.3728	1982.	68.3	0.494
-30.0	0.02559	-218.8	-0.3611	1903.	66.3	0.501
-20.0	0.02582	-213.8	-0.3495	1822.	64.2	0.508
-10.0	0.02606	-208.7	-0.3381	1741.	62.2	0.514
0.0	0.02630	-203.5	-0.3268	1658.	60.1	0.519
10.0	0.02656	-198.3	-0.3156	1576.	58.0	0.525
20.0	0.02682	-193.1	-0.3045	1494.	55.9	0.531
30.0	0.02709	-187.7	-0.2935	1412.	53.9	0.537
40.0	0.02738	-182.3	-0.2826	1332.	51.8	0.543
50.0	0.02768	-176.9	-0.2718	1253.	49.7	0.550
60.0	0.02799	-171.3	-0.2610	1175.	47.7	0.557
70.0	0.02831	-165.7	-0.2503	1099.	45.7	0.565
80.0	0.02865	-160.0	-0.2397	1024.	43.6	0.573
90.0	0.02901	-154.2	-0.2291	951.	41.7	0.581
100.0	0.02939	-148.4	-0.2185	880.	39.7	0.590
110.0	0.02979	-142.4	-0.2080	810.	37.7	0.600
120.0	0.03022	-136.3	-0.1974	742.	35.8	0.610
130.0	0.03068	-130.2	-0.1869	677.	33.9	0.621
140.0	0.03117	-123.9	-0.1764	612.	32.0	0.632
150.0	0.03170	-117.5	-0.1658	550.	30.1	0.645
160.0	0.03227	-111.0	-0.1552	489.	28.2	0.659
170.0	0.03291	-104.3	-0.1445	430.	26.3	0.675
180.0	0.03361	-97.4	-0.1337	372.	24.5	0.693
185.00	0.03399	-93.9	-0.1283	344.	23.5	0.703
COEXISTING VAPOR (X=.0517)						
185.00	0.4365	16.63	0.0385	58.6	0.5678	0.585

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

220 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02536	-223.7	-0.3729	1991.	68.5	0.494
-30.0	0.02558	-218.8	-0.3612	1912.	66.5	0.501
-20.0	0.02581	-213.7	-0.3496	1831.	64.4	0.508
-10.0	0.02605	-208.6	-0.3382	1749.	62.4	0.514
0.0	0.02629	-203.5	-0.3269	1666.	60.3	0.519
10.0	0.02655	-198.3	-0.3157	1584.	58.2	0.525
20.0	0.02681	-193.0	-0.3046	1502.	56.1	0.531
30.0	0.02708	-187.7	-0.2936	1420.	54.0	0.537
40.0	0.02737	-182.3	-0.2827	1339.	52.0	0.543
50.0	0.02766	-176.8	-0.2719	1260.	49.9	0.550
60.0	0.02797	-171.3	-0.2611	1182.	47.8	0.557
70.0	0.02830	-165.7	-0.2504	1106.	45.8	0.564
80.0	0.02864	-160.0	-0.2398	1031.	43.8	0.572
90.0	0.02900	-154.2	-0.2292	958.	41.8	0.581
100.0	0.02937	-148.3	-0.2187	887.	39.8	0.590
110.0	0.02977	-142.4	-0.2081	817.	37.9	0.599
120.0	0.03020	-136.3	-0.1976	750.	36.0	0.609
130.0	0.03065	-130.2	-0.1871	684.	34.1	0.620
140.0	0.03114	-123.9	-0.1765	620.	32.2	0.631
150.0	0.03166	-117.5	-0.1660	557.	30.3	0.644
160.0	0.03223	-111.0	-0.1554	497.	28.4	0.658
170.0	0.03286	-104.3	-0.1447	437.	26.5	0.673
180.0	0.03355	-97.5	-0.1340	380.	24.7	0.691
190.0	0.03433	-90.5	-0.1231	324.	22.8	0.712
193.68	0.03464	-87.8	-0.1190	303.	22.1	0.720
COEXISTING VAPOR (X=.0535)						
193.68	0.3919	18.83	0.0397	55.4	0.6454	0.607

240 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02535	-223.7	-0.3730	2001.	68.7	0.494
-30.0	0.02557	-218.7	-0.3613	1921.	66.7	0.501
-20.0	0.02580	-213.7	-0.3497	1840.	64.7	0.508
-10.0	0.02604	-208.6	-0.3383	1757.	62.6	0.513
0.0	0.02628	-203.4	-0.3270	1675.	60.5	0.519
10.0	0.02654	-198.2	-0.3158	1592.	58.4	0.525
20.0	0.02680	-193.0	-0.3047	1509.	56.3	0.530
30.0	0.02707	-187.6	-0.2937	1428.	54.2	0.536
40.0	0.02736	-182.2	-0.2828	1347.	52.1	0.543
50.0	0.02765	-176.8	-0.2720	1268.	50.1	0.549
60.0	0.02796	-171.2	-0.2613	1190.	48.0	0.557
70.0	0.02828	-165.6	-0.2506	1113.	46.0	0.564
80.0	0.02862	-159.9	-0.2399	1038.	44.0	0.572
90.0	0.02898	-154.2	-0.2294	965.	42.0	0.580
100.0	0.02935	-148.3	-0.2188	894.	40.0	0.589
110.0	0.02975	-142.4	-0.2083	825.	38.1	0.599
120.0	0.03017	-136.3	-0.1978	757.	36.1	0.609
130.0	0.03062	-130.2	-0.1872	691.	34.2	0.619
140.0	0.03110	-123.9	-0.1767	627.	32.3	0.631
150.0	0.03162	-117.5	-0.1662	565.	30.5	0.643
160.0	0.03219	-111.0	-0.1556	504.	28.6	0.657
170.0	0.03281	-104.4	-0.1450	445.	26.7	0.672
180.0	0.03349	-97.5	-0.1342	388.	24.9	0.689
190.0	0.03426	-90.5	-0.1234	332.	23.0	0.709
200.0	0.03514	-83.3	-0.1124	277.	21.1	0.733
201.80	0.03531	-82.0	-0.1104	267.	20.8	0.739
COEXISTING VAPOR (X=.0553)						
201.80	0.3543	20.78	0.0408	52.2	0.7281	0.631

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

260 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02534	-223.6	-0.3731	2010.	69.0	0.494
-30.0	0.02557	-218.7	-0.3614	1930.	66.9	0.501
-20.0	0.02580	-213.6	-0.3498	1848.	64.9	0.507
-10.0	0.02603	-208.5	-0.3384	1766.	62.8	0.513
0.0	0.02628	-203.4	-0.3271	1683.	60.7	0.519
10.0	0.02653	-198.2	-0.3159	1600.	58.6	0.524
20.0	0.02679	-192.9	-0.3048	1517.	56.5	0.530
30.0	0.02706	-187.6	-0.2938	1435.	54.4	0.536
40.0	0.02735	-182.2	-0.2829	1355.	52.3	0.542
50.0	0.02764	-176.7	-0.2721	1275.	50.2	0.549
60.0	0.02795	-171.2	-0.2614	1197.	48.2	0.556
70.0	0.02827	-165.6	-0.2507	1120.	46.2	0.564
80.0	0.02861	-159.9	-0.2401	1046.	44.1	0.572
90.0	0.02896	-154.1	-0.2295	973.	42.1	0.580
100.0	0.02933	-148.3	-0.2189	901.	40.2	0.589
110.0	0.02973	-142.3	-0.2084	832.	38.2	0.598
120.0	0.03015	-136.3	-0.1979	764.	36.3	0.608
130.0	0.03060	-130.1	-0.1874	698.	34.4	0.619
140.0	0.03107	-123.9	-0.1769	634.	32.5	0.630
150.0	0.03159	-117.5	-0.1664	572.	30.6	0.642
160.0	0.03215	-111.0	-0.1558	512.	28.8	0.655
170.0	0.03276	-104.4	-0.1452	453.	26.9	0.670
180.0	0.03343	-97.6	-0.1345	395.	25.1	0.687
190.0	0.03419	-90.6	-0.1237	340.	23.2	0.706
200.0	0.03505	-83.4	-0.1127	285.	21.3	0.730
209.44	0.03599	-76.4	-0.1021	235.	19.5	0.758
COEXISTING VAPOR (X=.0570)						
209.44	0.3221	22.53	0.0417	48.9	0.8162	0.657

280 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02534	-223.6	-0.3732	2019.	69.2	0.494
-30.0	0.02556	-218.6	-0.3615	1939.	67.2	0.501
-20.0	0.02579	-213.6	-0.3499	1857.	65.1	0.507
-10.0	0.02602	-208.5	-0.3385	1774.	63.0	0.513
0.0	0.02627	-203.3	-0.3272	1691.	60.9	0.519
10.0	0.02652	-198.1	-0.3160	1608.	58.8	0.524
20.0	0.02678	-192.9	-0.3049	1525.	56.7	0.530
30.0	0.02705	-187.5	-0.2940	1443.	54.6	0.536
40.0	0.02733	-182.2	-0.2831	1362.	52.5	0.542
50.0	0.02763	-176.7	-0.2722	1282.	50.4	0.549
60.0	0.02793	-171.2	-0.2615	1204.	48.4	0.556
70.0	0.02825	-165.5	-0.2508	1128.	46.3	0.563
80.0	0.02859	-159.9	-0.2402	1053.	44.3	0.571
90.0	0.02894	-154.1	-0.2296	980.	42.3	0.580
100.0	0.02932	-148.2	-0.2191	908.	40.3	0.588
110.0	0.02971	-142.3	-0.2086	839.	38.4	0.598
120.0	0.03012	-136.3	-0.1981	771.	36.5	0.607
130.0	0.03057	-130.1	-0.1876	706.	34.6	0.618
140.0	0.03104	-123.9	-0.1771	642.	32.7	0.629
150.0	0.03155	-117.5	-0.1666	579.	30.8	0.641
160.0	0.03211	-111.0	-0.1560	519.	29.0	0.654
170.0	0.03271	-104.4	-0.1454	460.	27.1	0.669
180.0	0.03338	-97.6	-0.1348	403.	25.3	0.685
190.0	0.03412	-90.7	-0.1240	347.	23.4	0.704
200.0	0.03496	-83.5	-0.1130	293.	21.6	0.727
210.0	0.03594	-76.1	-0.1019	240.	19.7	0.755
216.66	0.03670	-71.0	-0.0943	205.	18.4	0.780
COEXISTING VAPOR (X=.0587)						
216.66	0.2942	24.07	0.0424	45.7	0.9103	0.686

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

300 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02533	-223.5	-0.3732	2028.	69.5	0.494
-30.0	0.02555	-218.5	-0.3615	1948.	67.4	0.501
-20.0	0.02578	-213.5	-0.3500	1866.	65.3	0.507
-10.0	0.02602	-208.4	-0.3385	1783.	63.2	0.513
0.0	0.02626	-203.3	-0.3272	1699.	61.1	0.519
10.0	0.02651	-198.1	-0.3161	1616.	59.0	0.524
20.0	0.02677	-192.8	-0.3050	1533.	56.8	0.530
30.0	0.02704	-187.5	-0.2941	1451.	54.7	0.536
40.0	0.02732	-182.1	-0.2832	1370.	52.6	0.542
50.0	0.02762	-176.6	-0.2723	1290.	50.6	0.549
60.0	0.02792	-171.1	-0.2616	1212.	48.5	0.556
70.0	0.02824	-165.5	-0.2509	1135.	46.5	0.563
80.0	0.02858	-159.8	-0.2403	1060.	44.5	0.571
90.0	0.02893	-154.1	-0.2298	987.	42.5	0.579
100.0	0.02930	-148.2	-0.2192	916.	40.5	0.588
110.0	0.02969	-142.3	-0.2087	846.	38.6	0.597
120.0	0.03010	-136.2	-0.1982	778.	36.6	0.607
130.0	0.03054	-130.1	-0.1878	713.	34.7	0.617
140.0	0.03101	-123.9	-0.1773	649.	32.9	0.628
150.0	0.03152	-117.5	-0.1668	587.	31.0	0.640
160.0	0.03207	-111.0	-0.1562	526.	29.1	0.653
170.0	0.03266	-104.4	-0.1457	468.	27.3	0.667
180.0	0.03332	-97.7	-0.1350	411.	25.5	0.683
190.0	0.03405	-90.7	-0.1243	355.	23.6	0.702
200.0	0.03488	-83.6	-0.1134	301.	21.8	0.723
210.0	0.03583	-76.2	-0.1023	248.	19.9	0.751
220.0	0.03697	-68.5	-0.0909	197.	18.0	0.788
223.52	0.03743	-65.7	-0.0868	179.	17.3	0.804
COEXISTING VAPOR (X=.0604)						
223.52	0.2697	25.42	0.0431	42.4	1.0112	0.718

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

320 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02532	-223.4	-0.3733	2038.	69.7	0.493
-30.0	0.02555	-218.5	-0.3616	1957.	67.6	0.501
-20.0	0.02577	-213.4	-0.3501	1874.	65.5	0.507
-10.0	0.02601	-208.4	-0.3386	1791.	63.4	0.513
0.0	0.02625	-203.2	-0.3273	1707.	61.3	0.518
10.0	0.02650	-198.0	-0.3162	1624.	59.1	0.524
20.0	0.02676	-192.8	-0.3051	1540.	57.0	0.530
30.0	0.02703	-187.4	-0.2942	1458.	54.9	0.536
40.0	0.02731	-182.1	-0.2833	1377.	52.8	0.542
50.0	0.02760	-176.6	-0.2725	1297.	50.7	0.548
60.0	0.02791	-171.1	-0.2617	1219.	48.7	0.555
70.0	0.02823	-165.5	-0.2511	1142.	46.6	0.563
80.0	0.02856	-159.8	-0.2405	1067.	44.6	0.571
90.0	0.02891	-154.0	-0.2299	994.	42.6	0.579
100.0	0.02928	-148.2	-0.2194	923.	40.7	0.588
110.0	0.02967	-142.3	-0.2089	853.	38.7	0.597
120.0	0.03008	-136.2	-0.1984	786.	36.8	0.606
130.0	0.03052	-130.1	-0.1879	720.	34.9	0.617
140.0	0.03098	-123.9	-0.1775	656.	33.0	0.627
150.0	0.03149	-117.5	-0.1670	594.	31.2	0.639
160.0	0.03203	-111.1	-0.1565	534.	29.3	0.652
170.0	0.03262	-104.5	-0.1459	475.	27.5	0.666
180.0	0.03327	-97.7	-0.1353	418.	25.7	0.682
190.0	0.03399	-90.8	-0.1246	363.	23.9	0.699
200.0	0.03480	-83.7	-0.1137	309.	22.0	0.720
210.0	0.03573	-76.3	-0.1027	257.	20.2	0.747
220.0	0.03684	-68.7	-0.0913	205.	18.26	0.781
230.0	0.03820	-60.6	-0.0796	155.	16.26	0.831
230.04	0.03821	-60.6	-0.0795	154.	16.25	0.831
COEXISTING VAPOR (X=.0621)						
230.04	0.2479	26.59	0.0435	39.1	1.1197	0.754

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

340 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02532	-223.4	-0.3734	2047.	69.9	0.493
-30.0	0.02554	-218.4	-0.3617	1966.	67.8	0.501
-20.0	0.02577	-213.4	-0.3501	1883.	65.7	0.507
-10.0	0.02600	-208.3	-0.3387	1799.	63.6	0.513
0.0	0.02624	-203.2	-0.3274	1715.	61.5	0.518
10.0	0.02649	-198.0	-0.3163	1631.	59.3	0.524
20.0	0.02675	-192.7	-0.3052	1548.	57.2	0.529
30.0	0.02702	-187.4	-0.2943	1466.	55.1	0.535
40.0	0.02730	-182.0	-0.2834	1385.	53.0	0.542
50.0	0.02759	-176.5	-0.2726	1305.	50.9	0.548
60.0	0.02790	-171.0	-0.2618	1226.	48.8	0.555
70.0	0.02821	-165.4	-0.2512	1149.	46.8	0.563
80.0	0.02854	-159.7	-0.2406	1074.	44.8	0.570
90.0	0.02889	-154.0	-0.2300	1001.	42.8	0.578
100.0	0.02926	-148.2	-0.2195	930.	40.8	0.587
110.0	0.02965	-142.2	-0.2090	860.	38.9	0.596
120.0	0.03005	-136.2	-0.1986	793.	37.0	0.606
130.0	0.03049	-130.1	-0.1881	727.	35.1	0.616
140.0	0.03095	-123.9	-0.1776	663.	33.2	0.627
150.0	0.03145	-117.5	-0.1672	601.	31.3	0.638
160.0	0.03199	-111.1	-0.1567	541.	29.5	0.651
170.0	0.03257	-104.5	-0.1461	482.	27.7	0.665
180.0	0.03321	-97.7	-0.1355	426.	25.9	0.680
190.0	0.03392	-90.9	-0.1248	371.	24.1	0.697
200.0	0.03472	-83.8	-0.1140	317.	22.2	0.718
210.0	0.03563	-76.5	-0.1030	265.	20.4	0.743
220.0	0.03671	-68.9	-0.0918	214.	18.52	0.775
230.0	0.03802	-60.9	-0.0801	164.	16.56	0.821
236.27	0.03903	-55.6	-0.0725	132.	15.27	0.863
COEXISTING VAPOR (X=.0638)						
236.27	0.2285	27.57	0.0438	35.8	1.2368	0.796

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

360 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02531	-223.3	-0.3735	2056.	70.2	0.493
-30.0	0.02553	-218.4	-0.3618	1974.	68.1	0.501
-20.0	0.02576	-213.3	-0.3502	1891.	65.9	0.507
-10.0	0.02599	-208.2	-0.3388	1807.	63.8	0.513
0.0	0.02624	-203.1	-0.3275	1723.	61.6	0.518
10.0	0.02649	-197.9	-0.3164	1639.	59.5	0.524
20.0	0.02674	-192.7	-0.3053	1556.	57.4	0.529
30.0	0.02701	-187.3	-0.2944	1473.	55.3	0.535
40.0	0.02729	-182.0	-0.2835	1392.	53.2	0.541
50.0	0.02758	-176.5	-0.2727	1312.	51.1	0.548
60.0	0.02788	-171.0	-0.2620	1233.	49.0	0.555
70.0	0.02820	-165.4	-0.2513	1157.	47.0	0.562
80.0	0.02853	-159.7	-0.2407	1082.	44.9	0.570
90.0	0.02888	-154.0	-0.2302	1008.	43.0	0.578
100.0	0.02924	-148.1	-0.2196	937.	41.0	0.587
110.0	0.02963	-142.2	-0.2092	867.	39.0	0.596
120.0	0.03003	-136.2	-0.1987	800.	37.1	0.605
130.0	0.03046	-130.1	-0.1883	734.	35.2	0.615
140.0	0.03093	-123.9	-0.1778	670.	33.4	0.626
150.0	0.03142	-117.5	-0.1674	608.	31.5	0.637
160.0	0.03195	-111.1	-0.1569	548.	29.7	0.650
170.0	0.03253	-104.5	-0.1464	490.	27.9	0.663
180.0	0.03316	-97.8	-0.1358	433.	26.1	0.678
190.0	0.03386	-90.9	-0.1251	378.	24.3	0.695
200.0	0.03465	-83.8	-0.1143	325.	22.5	0.715
210.0	0.03554	-76.6	-0.1034	273.	20.6	0.739
220.0	0.03658	-69.0	-0.0922	222.	18.78	0.769
230.0	0.03784	-61.1	-0.0807	172.	16.86	0.812
240.0	0.03946	-52.7	-0.0685	123.	14.81	0.879
242.24	0.03990	-50.7	-0.0657	112.	14.33	0.900
COEXISTING VAPOR (X=.0656)						
242.24	0.2108	28.36	0.0439	32.5	1.3640	0.846

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

380 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02530	-223.3	-0.3736	2065.	70.4	0.493
-30.0	0.02553	-218.3	-0.3619	1983.	68.3	0.500
-20.0	0.02575	-213.3	-0.3503	1900.	66.1	0.507
-10.0	0.02599	-208.2	-0.3389	1816.	64.0	0.513
0.0	0.02623	-203.0	-0.3276	1731.	61.8	0.518
10.0	0.02648	-197.9	-0.3164	1647.	59.7	0.524
20.0	0.02673	-192.6	-0.3054	1564.	57.6	0.529
30.0	0.02700	-187.3	-0.2945	1481.	55.4	0.535
40.0	0.02728	-181.9	-0.2836	1399.	53.3	0.541
50.0	0.02757	-176.5	-0.2728	1319.	51.2	0.548
60.0	0.02787	-170.9	-0.2621	1241.	49.2	0.555
70.0	0.02819	-165.3	-0.2514	1164.	47.1	0.562
80.0	0.02851	-159.7	-0.2408	1089.	45.1	0.570
90.0	0.02886	-153.9	-0.2303	1015.	43.1	0.578
100.0	0.02922	-148.1	-0.2198	944.	41.1	0.586
110.0	0.02960	-142.2	-0.2093	874.	39.2	0.595
120.0	0.03001	-136.2	-0.1989	807.	37.3	0.605
130.0	0.03044	-130.1	-0.1884	741.	35.4	0.615
140.0	0.03090	-123.8	-0.1780	677.	33.5	0.625
150.0	0.03139	-117.5	-0.1675	615.	31.7	0.637
160.0	0.03192	-111.1	-0.1571	555.	29.9	0.649
170.0	0.03249	-104.5	-0.1466	497.	28.0	0.662
180.0	0.03311	-97.8	-0.1360	441.	26.2	0.677
190.0	0.03380	-91.0	-0.1254	386.	24.5	0.693
200.0	0.03457	-83.9	-0.1146	332.	22.7	0.712
210.0	0.03545	-76.7	-0.1037	281.	20.9	0.735
220.0	0.03646	-69.2	-0.0926	230.	19.03	0.764
230.0	0.03768	-61.3	-0.0812	181.	17.14	0.803
240.0	0.03922	-53.0	-0.0692	133.	15.15	0.863
247.96	0.04085	-45.8	-0.0590	94.	13.42	0.946
COEXISTING VAPOR (X=.0674)						
247.96	0.1947	28.96	0.0439	29.1	1.5028	0.907

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

400 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02530	-223.2	-0.3736	2074.	70.6	0.493
-30.0	0.02552	-218.2	-0.3620	1992.	68.5	0.500
-20.0	0.02575	-213.2	-0.3504	1908.	66.3	0.507
-10.0	0.02598	-208.1	-0.3390	1824.	64.2	0.512
0.0	0.02622	-203.0	-0.3277	1739.	62.0	0.518
10.0	0.02647	-197.8	-0.3165	1655.	59.9	0.523
20.0	0.02673	-192.6	-0.3055	1571.	57.7	0.529
30.0	0.02699	-187.2	-0.2946	1488.	55.6	0.535
40.0	0.02727	-181.9	-0.2837	1407.	53.5	0.541
50.0	0.02756	-176.4	-0.2729	1327.	51.4	0.548
60.0	0.02786	-170.9	-0.2622	1248.	49.3	0.554
70.0	0.02817	-165.3	-0.2515	1171.	47.3	0.562
80.0	0.02850	-159.6	-0.2410	1096.	45.3	0.569
90.0	0.02884	-153.9	-0.2304	1022.	43.3	0.577
100.0	0.02920	-148.1	-0.2199	951.	41.3	0.586
110.0	0.02958	-142.1	-0.2095	881.	39.4	0.595
120.0	0.02999	-136.1	-0.1990	814.	37.4	0.604
130.0	0.03041	-130.0	-0.1886	748.	35.6	0.614
140.0	0.03087	-123.8	-0.1782	684.	33.7	0.625
150.0	0.03136	-117.5	-0.1677	622.	31.8	0.636
160.0	0.03188	-111.1	-0.1573	562.	30.0	0.648
170.0	0.03245	-104.5	-0.1468	504.	28.2	0.661
180.0	0.03306	-97.8	-0.1363	448.	26.4	0.675
190.0	0.03374	-91.0	-0.1257	393.	24.7	0.691
200.0	0.03450	-84.0	-0.1149	340.	22.9	0.710
210.0	0.03536	-76.8	-0.1041	289.	21.1	0.732
220.0	0.03635	-69.3	-0.0930	239.	19.27	0.759
230.0	0.03753	-61.5	-0.0817	190.	17.41	0.796
240.0	0.03900	-53.3	-0.0698	142.	15.47	0.850
250.0	0.04098	-44.3	-0.0571	94.	13.35	0.945
253.46	0.04189	-41.0	-0.0524	77.	12.54	1.002
COEXISTING VAPOR (X=.0692)						
253.46	0.1799	29.34	0.0436	25.8	1.6554	0.982

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

420 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02529	-223.1	-0.3737	2083.	70.9	0.493
-30.0	0.02551	-218.2	-0.3620	2001.	68.7	0.500
-20.0	0.02574	-213.2	-0.3505	1917.	66.5	0.507
-10.0	0.02597	-208.1	-0.3391	1832.	64.4	0.512
0.0	0.02621	-202.9	-0.3278	1747.	62.2	0.518
10.0	0.02646	-197.7	-0.3166	1663.	60.1	0.523
20.0	0.02672	-192.5	-0.3056	1579.	57.9	0.529
30.0	0.02698	-187.2	-0.2947	1496.	55.8	0.535
40.0	0.02726	-181.8	-0.2838	1414.	53.7	0.541
50.0	0.02755	-176.4	-0.2730	1334.	51.6	0.547
60.0	0.02785	-170.8	-0.2623	1255.	49.5	0.554
70.0	0.02816	-165.3	-0.2517	1178.	47.4	0.561
80.0	0.02848	-159.6	-0.2411	1103.	45.4	0.569
90.0	0.02883	-153.9	-0.2305	1029.	43.4	0.577
100.0	0.02919	-148.0	-0.2201	958.	41.5	0.585
110.0	0.02956	-142.1	-0.2096	888.	39.5	0.594
120.0	0.02996	-136.1	-0.1992	821.	37.6	0.604
130.0	0.03039	-130.0	-0.1888	755.	35.7	0.613
140.0	0.03084	-123.8	-0.1783	691.	33.9	0.624
150.0	0.03132	-117.5	-0.1679	630.	32.0	0.635
160.0	0.03184	-111.1	-0.1575	570.	30.2	0.647
170.0	0.03240	-104.6	-0.1470	511.	28.4	0.660
180.0	0.03301	-97.9	-0.1365	455.	26.6	0.674
190.0	0.03369	-91.1	-0.1259	401.	24.8	0.690
200.0	0.03443	-84.1	-0.1152	348.	23.1	0.708
210.0	0.03527	-76.9	-0.1044	296.	21.3	0.729
220.0	0.03624	-69.4	-0.0934	247.	19.51	0.755
230.0	0.03738	-61.7	-0.0821	198.	17.68	0.789
240.0	0.03879	-53.6	-0.0704	151.	15.77	0.838
250.0	0.04064	-44.8	-0.0580	104.	13.73	0.920
258.76	0.04304	-36.1	-0.0459	62.	11.69	1.076
COEXISTING VAPOR (X=.0712)						
258.76	0.1660	29.47	0.0431	22.4	1.8254	1.079

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

440 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02529	-223.1	-0.3738	2092.	71.1	0.493
-30.0	0.02551	-218.1	-0.3621	2009.	68.9	0.500
-20.0	0.02573	-213.1	-0.3506	1925.	66.8	0.506
-10.0	0.02596	-208.0	-0.3392	1840.	64.6	0.512
0.0	0.02620	-202.9	-0.3279	1755.	62.4	0.518
10.0	0.02645	-197.7	-0.3167	1670.	60.2	0.523
20.0	0.02671	-192.5	-0.3057	1586.	58.1	0.529
30.0	0.02697	-187.1	-0.2948	1503.	55.9	0.534
40.0	0.02725	-181.8	-0.2839	1421.	53.8	0.541
50.0	0.02753	-176.3	-0.2731	1341.	51.7	0.547
60.0	0.02783	-170.8	-0.2624	1262.	49.6	0.554
70.0	0.02814	-165.2	-0.2518	1185.	47.6	0.561
80.0	0.02847	-159.6	-0.2412	1110.	45.6	0.569
90.0	0.02881	-153.8	-0.2307	1036.	43.6	0.577
100.0	0.02917	-148.0	-0.2202	965.	41.6	0.585
110.0	0.02955	-142.1	-0.2097	895.	39.7	0.594
120.0	0.02994	-136.1	-0.1993	828.	37.8	0.603
130.0	0.03036	-130.0	-0.1889	762.	35.9	0.613
140.0	0.03081	-123.8	-0.1785	698.	34.0	0.623
150.0	0.03129	-117.5	-0.1681	637.	32.2	0.634
160.0	0.03181	-111.1	-0.1577	577.	30.4	0.646
170.0	0.03236	-104.6	-0.1472	519.	28.6	0.659
180.0	0.03297	-97.9	-0.1367	462.	26.8	0.672
190.0	0.03363	-91.1	-0.1262	408.	25.0	0.688
200.0	0.03436	-84.1	-0.1155	355.	23.3	0.705
210.0	0.03519	-77.0	-0.1047	304.	21.5	0.726
220.0	0.03614	-69.6	-0.0938	254.	19.74	0.751
230.0	0.03724	-61.9	-0.0826	206.	17.93	0.783
240.0	0.03859	-53.8	-0.0710	159.	16.07	0.827
250.0	0.04034	-45.2	-0.0588	113.	14.09	0.899
260.0	0.04289	-35.5	-0.0453	67.	11.86	1.048
263.87	0.04435	-31.3	-0.0393	49.	10.85	1.176
COEXISTING VAPOR (X=.0733)						
263.87	0.1530	29.3	0.0422	19.	2.017	1.210

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

460 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02528	-223.0	-0.3739	2101.	71.3	0.493
-30.0	0.02550	-218.1	-0.3622	2018.	69.1	0.500
-20.0	0.02572	-213.0	-0.3507	1934.	67.0	0.506
-10.0	0.02596	-208.0	-0.3393	1848.	64.8	0.512
0.0	0.02620	-202.8	-0.3280	1763.	62.6	0.517
10.0	0.02644	-197.6	-0.3168	1678.	60.4	0.523
20.0	0.02670	-192.4	-0.3058	1594.	58.3	0.528
30.0	0.02696	-187.1	-0.2949	1511.	56.1	0.534
40.0	0.02724	-181.7	-0.2840	1429.	54.0	0.540
50.0	0.02752	-176.3	-0.2732	1348.	51.9	0.547
60.0	0.02782	-170.8	-0.2625	1269.	49.8	0.554
70.0	0.02813	-165.2	-0.2519	1192.	47.8	0.561
80.0	0.02845	-159.5	-0.2413	1117.	45.7	0.568
90.0	0.02879	-153.8	-0.2308	1043.	43.7	0.576
100.0	0.02915	-148.0	-0.2203	972.	41.8	0.585
110.0	0.02953	-142.1	-0.2099	902.	39.8	0.593
120.0	0.02992	-136.1	-0.1995	835.	37.9	0.603
130.0	0.03034	-130.0	-0.1891	769.	36.0	0.612
140.0	0.03079	-123.8	-0.1787	705.	34.2	0.623
150.0	0.03126	-117.5	-0.1683	644.	32.3	0.633
160.0	0.03177	-111.1	-0.1579	584.	30.5	0.645
170.0	0.03232	-104.6	-0.1474	526.	28.7	0.657
180.0	0.03292	-97.9	-0.1370	470.	27.0	0.671
190.0	0.03357	-91.1	-0.1264	415.	25.2	0.686
200.0	0.03430	-84.2	-0.1158	363.	23.5	0.703
210.0	0.03511	-77.0	-0.1051	312.	21.7	0.723
220.0	0.03603	-69.7	-0.0942	262.	19.97	0.747
230.0	0.03711	-62.0	-0.0830	214.	18.18	0.777
240.0	0.03841	-54.1	-0.0715	168.	16.35	0.818
250.0	0.04006	-45.6	-0.0595	122.	14.42	0.881
260.0	0.04238	-36.2	-0.0464	77.	12.30	1.001
268.80	0.04587	-26.3	-0.0327	37.	10.02	1.321
COEXISTING VAPOR (X=.0756)						
268.80	0.1405	28.8	0.0410	16.	2.236	1.399

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

480 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02527	-223.0	-0.3740	2110.	71.5	0.493
-30.0	0.02549	-218.0	-0.3623	2027.	69.4	0.500
-20.0	0.02572	-213.0	-0.3507	1942.	67.2	0.506
-10.0	0.02595	-207.9	-0.3393	1857.	65.0	0.512
0.0	0.02619	-202.8	-0.3281	1771.	62.8	0.517
10.0	0.02643	-197.6	-0.3169	1686.	60.6	0.523
20.0	0.02669	-192.3	-0.3059	1602.	58.4	0.528
30.0	0.02695	-187.0	-0.2950	1518.	56.3	0.534
40.0	0.02723	-181.7	-0.2841	1436.	54.1	0.540
50.0	0.02751	-176.2	-0.2733	1356.	52.0	0.547
60.0	0.02781	-170.7	-0.2626	1277.	50.0	0.553
70.0	0.02812	-165.1	-0.2520	1199.	47.9	0.561
80.0	0.02844	-159.5	-0.2414	1124.	45.9	0.568
90.0	0.02878	-153.7	-0.2309	1050.	43.9	0.576
100.0	0.02913	-147.9	-0.2205	979.	41.9	0.584
110.0	0.02951	-142.0	-0.2100	909.	40.0	0.593
120.0	0.02990	-136.1	-0.1996	842.	38.1	0.602
130.0	0.03032	-130.0	-0.1892	776.	36.2	0.612
140.0	0.03076	-123.8	-0.1789	712.	34.3	0.622
150.0	0.03123	-117.5	-0.1685	651.	32.5	0.633
160.0	0.03174	-111.1	-0.1581	591.	30.7	0.644
170.0	0.03228	-104.6	-0.1477	533.	28.9	0.656
180.0	0.03287	-98.0	-0.1372	477.	27.2	0.670
190.0	0.03352	-91.2	-0.1267	423.	25.4	0.685
200.0	0.03423	-84.2	-0.1161	370.	23.7	0.701
210.0	0.03503	-77.1	-0.1054	319.	21.9	0.720
220.0	0.03594	-69.8	-0.0945	270.	20.2	0.743
230.0	0.03699	-62.2	-0.0835	222.	18.42	0.772
240.0	0.03824	-54.3	-0.0721	176.	16.62	0.810
250.0	0.03981	-45.9	-0.0602	131.	14.74	0.866
260.0	0.04194	-36.8	-0.0474	87.	12.70	0.966
270.0	0.04545	-26.0	-0.0326	42.8	10.29	1.235
273.58	0.04771	-21.1	-0.0258	26.1	9.18	1.550
COEXISTING VAPOR (X=.0782)						
273.58	0.1283	27.9	0.0392	12.2	2.495	1.692

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

500 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02527	-222.9	-0.3740	2119.	71.8	0.493
-30.0	0.02549	-217.9	-0.3624	2035.	69.6	0.500
-20.0	0.02571	-212.9	-0.3508	1950.	67.4	0.506
-10.0	0.02594	-207.8	-0.3394	1865.	65.2	0.512
0.0	0.02618	-202.7	-0.3282	1779.	63.0	0.517
10.0	0.02643	-197.5	-0.3170	1694.	60.8	0.523
20.0	0.02668	-192.3	-0.3060	1609.	58.6	0.528
30.0	0.02694	-187.0	-0.2951	1526.	56.4	0.534
40.0	0.02722	-181.6	-0.2842	1443.	54.3	0.540
50.0	0.02750	-176.2	-0.2734	1363.	52.2	0.546
60.0	0.02780	-170.7	-0.2627	1284.	50.1	0.553
70.0	0.02810	-165.1	-0.2521	1206.	48.1	0.560
80.0	0.02843	-159.4	-0.2416	1131.	46.0	0.568
90.0	0.02876	-153.7	-0.2311	1057.	44.0	0.576
100.0	0.02912	-147.9	-0.2206	986.	42.1	0.584
110.0	0.02949	-142.0	-0.2102	916.	40.1	0.593
120.0	0.02988	-136.0	-0.1998	848.	38.2	0.602
130.0	0.03029	-130.0	-0.1894	783.	36.3	0.611
140.0	0.03073	-123.8	-0.1790	719.	34.5	0.621
150.0	0.03120	-117.5	-0.1686	657.	32.7	0.632
160.0	0.03170	-111.1	-0.1583	598.	30.9	0.643
170.0	0.03224	-104.6	-0.1479	540.	29.1	0.655
180.0	0.03283	-98.0	-0.1374	484.	27.3	0.669
190.0	0.03347	-91.2	-0.1269	430.	25.6	0.683
200.0	0.03417	-84.3	-0.1164	377.	23.9	0.699
210.0	0.03495	-77.2	-0.1057	327.	22.1	0.718
220.0	0.03584	-69.9	-0.0949	278.	20.4	0.740
230.0	0.03686	-62.4	-0.0839	230.	18.66	0.767
240.0	0.03808	-54.5	-0.0726	184.	16.89	0.803
250.0	0.03957	-46.2	-0.0608	140.	15.04	0.853
260.0	0.04156	-37.3	-0.0483	97.	13.08	0.938
270.0	0.04460	-27.1	-0.0342	53.7	10.84	1.131
278.21	0.05006	-15.5	-0.0186	16.8	8.31	1.967
COEXISTING VAPOR (X=.0812)						
278.21	0.1161	26.3	0.0367	8.8	2.812	2.207

TABLE 5B (CONT.) THERMODYNAMIC PROPERTIES ALONG ISOBARS IN THE LIQUID

520 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02526	-222.8	-0.3741	2128.	72.0	0.493
-30.0	0.02548	-217.9	-0.3625	2044.	69.8	0.500
-20.0	0.02570	-212.9	-0.3509	1959.	67.6	0.506
-10.0	0.02593	-207.8	-0.3395	1873.	65.3	0.512
0.0	0.02617	-202.7	-0.3282	1787.	63.1	0.517
10.0	0.02642	-197.5	-0.3171	1701.	60.9	0.522
20.0	0.02667	-192.2	-0.3061	1617.	58.8	0.528
30.0	0.02693	-186.9	-0.2952	1533.	56.6	0.534
40.0	0.02721	-181.6	-0.2843	1451.	54.5	0.540
50.0	0.02749	-176.1	-0.2735	1370.	52.4	0.546
60.0	0.02778	-170.6	-0.2629	1291.	50.3	0.553
70.0	0.02809	-165.0	-0.2522	1213.	48.2	0.560
80.0	0.02841	-159.4	-0.2417	1138.	46.2	0.568
90.0	0.02875	-153.7	-0.2312	1064.	44.2	0.575
100.0	0.02910	-147.9	-0.2207	993.	42.2	0.584
110.0	0.02947	-142.0	-0.2103	923.	40.3	0.592
120.0	0.02986	-136.0	-0.1999	855.	38.4	0.601
130.0	0.03027	-129.9	-0.1895	790.	36.5	0.611
140.0	0.03071	-123.8	-0.1792	726.	34.6	0.621
150.0	0.03117	-117.5	-0.1688	664.	32.8	0.631
160.0	0.03167	-111.1	-0.1585	605.	31.0	0.642
170.0	0.03221	-104.6	-0.1481	547.	29.3	0.654
180.0	0.03278	-98.0	-0.1376	491.	27.5	0.667
190.0	0.03342	-91.3	-0.1272	437.	25.8	0.682
200.0	0.03411	-84.3	-0.1166	385.	24.0	0.697
210.0	0.03488	-77.3	-0.1060	334.	22.3	0.715
220.0	0.03575	-70.0	-0.0952	285.	20.6	0.737
230.0	0.03675	-62.5	-0.0843	238.	18.9	0.762
240.0	0.03792	-54.7	-0.0730	193.	17.1	0.796
250.0	0.03936	-46.5	-0.0614	148.	15.3	0.842
260.0	0.04122	-37.7	-0.0492	105.6	13.4	0.915
270.0	0.04393	-27.9	-0.0356	63.8	11.3	1.063
280.0	0.04942	-15.1	-0.0182	21.6	8.58	1.695

TABLE 5C. THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

540 PSIA

	T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
	-40.0	0.02526	-222.8	-0.3742	2137.	72.2	0.493
	-30.0	0.02547	-217.8	-0.3625	2053.	70.0	0.500
	-20.0	0.02570	-212.8	-0.3510	1967.	67.8	0.506
	-10.0	0.02593	-207.7	-0.3396	1881.	65.5	0.512
	0.0	0.02616	-202.6	-0.3283	1795.	63.3	0.517
	10.0	0.02641	-197.4	-0.3172	1709.	61.1	0.522
	20.0	0.02666	-192.2	-0.3062	1624.	58.9	0.528
	30.0	0.02692	-186.9	-0.2953	1540.	56.8	0.534
	40.0	0.02720	-181.5	-0.2844	1458.	54.6	0.540
	50.0	0.02748	-176.1	-0.2737	1377.	52.5	0.546
	60.0	0.02777	-170.6	-0.2630	1298.	50.4	0.553
	70.0	0.02808	-165.0	-0.2524	1220.	48.4	0.560
	80.0	0.02840	-159.4	-0.2418	1145.	46.3	0.567
	90.0	0.02873	-153.6	-0.2313	1071.	44.3	0.575
	100.0	0.02908	-147.8	-0.2209	999.	42.4	0.583
	110.0	0.02945	-142.0	-0.2105	930.	40.4	0.592
	120.0	0.02984	-136.0	-0.2001	862.	38.5	0.601
	130.0	0.03025	-129.9	-0.1897	796.	36.6	0.610
	140.0	0.03068	-123.8	-0.1794	733.	34.8	0.620
	150.0	0.03114	-117.5	-0.1690	671.	33.0	0.630
	160.0	0.03164	-111.1	-0.1586	612.	31.2	0.641
	170.0	0.03217	-104.6	-0.1483	554.	29.4	0.653
	180.0	0.03274	-98.0	-0.1379	498.	27.7	0.666
	190.0	0.03336	-91.3	-0.1274	444.	25.9	0.680
	200.0	0.03405	-84.4	-0.1169	392.	24.2	0.696
	210.0	0.03481	-77.3	-0.1063	342.	22.5	0.713
	220.0	0.03566	-70.1	-0.0956	293.	20.8	0.734
	230.0	0.03664	-62.6	-0.0847	246.	19.1	0.758
	240.0	0.03778	-54.9	-0.0735	201.	17.4	0.789
	250.0	0.03915	-46.8	-0.0620	157.	15.6	0.832
	260.0	0.04091	-38.1	-0.0499	114.5	13.8	0.896
	270.0	0.04337	-28.6	-0.0368	73.4	11.7	1.015
	280.0	0.04767	-17.1	-0.0211	33.2	9.33	1.367
*	290.0	0.10074	26.2	0.0368	7.1	3.29	2.730
	300.0	0.12739	42.3	0.0582	21.7	2.42	1.173
	310.0	0.14268	52.6	0.0717	32.0	2.07	0.940
	320.0	0.15462	61.5	0.0832	40.5	1.84	0.840
	330.0	0.16481	69.6	0.0935	47.9	1.68	0.786
	340.0	0.17389	77.3	0.1032	54.5	1.56	0.751
	350.0	0.18218	84.7	0.1124	60.6	1.45	0.729
	360.0	0.18989	91.9	0.1212	66.3	1.37	0.713
	370.0	0.19715	99.0	0.1298	71.6	1.30	0.702
	380.0	0.2040	106.0	0.1382	76.7	1.24	0.694
	390.0	0.2106	112.9	0.1464	81.5	1.18	0.689
	400.0	0.2170	119.8	0.1544	86.1	1.14	0.685
	420.0	0.2291	133.4	0.1701	94.7	1.06	0.682
	440.0	0.2405	147.1	0.1854	102.8	0.989	0.681
	460.0	0.2514	160.7	0.2004	110.4	0.932	0.683
	480.0	0.2619	174.4	0.2152	117.7	0.884	0.687
	500.0	0.2720	188.2	0.2297	125.	0.842	0.692
	520.0	0.2819	202.1	0.2440	131.	0.804	0.697
	540.0	0.2915	216.1	0.2581	138.	0.771	0.703
	560.0	0.3010	230.2	0.2721	144.	0.741	0.709
	580.0	0.3102	244.4	0.2860	150.	0.714	0.716
	600.0	0.3193	258.8	0.2996	156.	0.689	0.722

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

560 PSIA

	T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
	-40.0	0.02525	-222.7	-0.3743	2146.	72.4	0.492
	-30.0	0.02547	-217.8	-0.3626	2061.	70.2	0.500
	-20.0	0.02569	-212.7	-0.3511	1975.	68.0	0.506
	-10.0	0.02592	-207.7	-0.3397	1889.	65.7	0.511
	0.0	0.02616	-202.5	-0.3284	1803.	63.5	0.517
	10.0	0.02640	-197.4	-0.3173	1717.	61.3	0.522
	20.0	0.02665	-192.1	-0.3063	1632.	59.1	0.528
	30.0	0.02692	-186.8	-0.2954	1548.	56.9	0.533
	40.0	0.02719	-181.5	-0.2845	1465.	54.8	0.539
	50.0	0.02747	-176.0	-0.2738	1384.	52.7	0.546
	60.0	0.02776	-170.5	-0.2631	1305.	50.6	0.552
	70.0	0.02807	-165.0	-0.2525	1227.	48.5	0.560
	80.0	0.02838	-159.3	-0.2419	1152.	46.5	0.567
	90.0	0.02872	-153.6	-0.2314	1078.	44.5	0.575
	100.0	0.02906	-147.8	-0.2210	1006.	42.5	0.583
	110.0	0.02943	-141.9	-0.2106	937.	40.6	0.591
	120.0	0.02982	-136.0	-0.2002	869.	38.7	0.600
	130.0	0.03022	-129.9	-0.1899	803.	36.8	0.610
	140.0	0.03065	-123.7	-0.1795	740.	35.0	0.619
	150.0	0.03111	-117.5	-0.1692	678.	33.1	0.630
	160.0	0.03160	-111.1	-0.1588	618.	31.3	0.641
	170.0	0.03213	-104.6	-0.1485	561.	29.6	0.652
	180.0	0.03270	-98.0	-0.1381	505.	27.8	0.665
	190.0	0.03331	-91.3	-0.1277	451.	26.1	0.679
	200.0	0.03399	-84.4	-0.1172	399.	24.4	0.694
	210.0	0.03474	-77.4	-0.1066	349.	22.7	0.711
	220.0	0.03557	-70.2	-0.0959	300.	21.0	0.731
	230.0	0.03653	-62.8	-0.0850	254.	19.3	0.754
	240.0	0.03764	-55.1	-0.0740	208.	17.6	0.784
	250.0	0.03896	-47.0	-0.0626	165.	15.9	0.823
	260.0	0.04063	-38.5	-0.0507	123.	14.1	0.880
	270.0	0.04289	-29.2	-0.0379	82.7	12.1	0.979
	280.0	0.04650	-18.4	-0.0232	43.7	9.93	1.216
*	290.0	0.05798	-0.3	0.0011	6.1	6.49	3.806
	300.0	0.11181	36.9	0.0506	15.2	2.86	1.506
	310.0	0.13000	49.2	0.0666	26.7	2.33	1.046
	320.0	0.14303	58.8	0.0790	35.9	2.04	0.896
	330.0	0.15375	67.4	0.0899	43.8	1.84	0.821
	340.0	0.16312	75.3	0.0999	50.8	1.69	0.776
	350.0	0.17157	82.9	0.1094	57.3	1.57	0.747
	360.0	0.17937	90.3	0.1185	63.2	1.47	0.727
	370.0	0.18666	97.5	0.1272	68.7	1.39	0.714
	380.0	0.19356	104.6	0.1357	73.9	1.32	0.704
	390.0	0.2001	111.6	0.1440	78.9	1.26	0.697
	400.0	0.2064	118.6	0.1521	83.6	1.21	0.692
	420.0	0.2184	132.4	0.1680	92.5	1.12	0.687
	440.0	0.2296	146.1	0.1834	100.8	1.05	0.686
	460.0	0.2403	159.8	0.1985	108.6	0.985	0.687
	480.0	0.2506	173.6	0.2133	116.0	0.932	0.690
	500.0	0.2606	187.4	0.2278	123.	0.886	0.694
	520.0	0.2702	201.3	0.2422	130.	0.846	0.699
	540.0	0.2797	215.4	0.2564	137.	0.810	0.705
	560.0	0.2888	229.5	0.2704	143.	0.778	0.711
	580.0	0.2978	243.8	0.2843	149.	0.749	0.717
	600.0	0.3067	258.2	0.2980	155.	0.722	0.724

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

580 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02524	-222.7	-0.3744	2155.	72.7	0.492
-30.0	0.02546	-217.7	-0.3627	2070.	70.4	0.500
-20.0	0.02568	-212.7	-0.3512	1984.	68.2	0.506
-10.0	0.02591	-207.6	-0.3398	1897.	65.9	0.511
0.0	0.02615	-202.5	-0.3285	1810.	63.7	0.517
10.0	0.02639	-197.3	-0.3174	1724.	61.5	0.522
20.0	0.02665	-192.1	-0.3064	1639.	59.3	0.528
30.0	0.02691	-186.8	-0.2955	1555.	57.1	0.533
40.0	0.02718	-181.4	-0.2846	1472.	55.0	0.539
50.0	0.02746	-176.0	-0.2739	1391.	52.8	0.546
60.0	0.02775	-170.5	-0.2632	1312.	50.7	0.552
70.0	0.02805	-164.9	-0.2526	1234.	48.7	0.559
80.0	0.02837	-159.3	-0.2421	1159.	46.6	0.567
90.0	0.02870	-153.6	-0.2316	1085.	44.6	0.574
100.0	0.02905	-147.8	-0.2211	1013.	42.7	0.582
110.0	0.02941	-141.9	-0.2107	943.	40.7	0.591
120.0	0.02980	-135.9	-0.2004	876.	38.8	0.600
130.0	0.03020	-129.9	-0.1900	810.	37.0	0.609
140.0	0.03063	-123.7	-0.1797	746.	35.1	0.619
150.0	0.03109	-117.5	-0.1694	685.	33.3	0.629
160.0	0.03157	-111.1	-0.1590	625.	31.5	0.640
170.0	0.03209	-104.7	-0.1487	568.	29.7	0.651
180.0	0.03266	-98.1	-0.1383	512.	28.0	0.664
190.0	0.03327	-91.3	-0.1279	458.	26.3	0.677
200.0	0.03393	-84.5	-0.1174	406.	24.6	0.692
210.0	0.03467	-77.5	-0.1069	356.	22.9	0.709
220.0	0.03549	-70.3	-0.0962	308.	21.2	0.728
230.0	0.03642	-62.9	-0.0854	261.	19.6	0.750
240.0	0.03750	-55.2	-0.0744	216.	17.9	0.778
250.0	0.03878	-47.3	-0.0631	173.	16.2	0.815
260.0	0.04037	-38.8	-0.0513	132.	14.4	0.866
270.0	0.04247	-29.8	-0.0388	91.6	12.5	0.950
280.0	0.04562	-19.5	-0.0248	53.5	10.4	1.125
290.0	0.05236	-5.6	-0.0062	17.6	7.76	1.864
300.0	0.09387	29.3	0.0400	8.9	3.55	2.331
310.0	0.11729	45.1	0.0607	21.5	2.66	1.208
320.0	0.13180	55.8	0.0745	31.4	2.27	0.968
330.0	0.14320	64.9	0.0862	39.8	2.02	0.863
340.0	0.15293	73.3	0.0966	47.2	1.84	0.804
350.0	0.16159	81.1	0.1064	53.9	1.70	0.768
360.0	0.16950	88.7	0.1157	60.0	1.59	0.743
370.0	0.17684	96.0	0.1246	65.8	1.49	0.726
380.0	0.18375	103.2	0.1332	71.2	1.41	0.714
390.0	0.19030	110.3	0.1416	76.3	1.35	0.706
400.0	0.19657	117.4	0.1498	81.1	1.29	0.700
420.0	0.2084	131.3	0.1658	90.3	1.19	0.693
440.0	0.2195	145.1	0.1814	98.7	1.11	0.690
460.0	0.2301	158.9	0.1965	106.7	1.04	0.691
480.0	0.2402	172.7	0.2114	114.3	0.981	0.693
500.0	0.2499	186.6	0.2261	122.	0.932	0.697
520.0	0.2594	200.6	0.2405	128.	0.889	0.701
540.0	0.2686	214.7	0.2547	135.	0.850	0.707
560.0	0.2776	228.9	0.2688	142.	0.816	0.713
580.0	0.2864	243.2	0.2827	148.	0.784	0.719
600.0	0.2950	257.6	0.2964	154.	0.756	0.725

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

600 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02524	-222.6	-0.3744	2164.	72.9	0.492
-30.0	0.02545	-217.7	-0.3628	2078.	70.6	0.499
-20.0	0.02568	-212.6	-0.3513	1992.	68.4	0.506
-10.0	0.02591	-207.6	-0.3399	1905.	66.1	0.511
0.0	0.02614	-202.4	-0.3286	1818.	63.9	0.517
10.0	0.02639	-197.3	-0.3175	1732.	61.6	0.522
20.0	0.02664	-192.0	-0.3065	1647.	59.4	0.527
30.0	0.02690	-186.7	-0.2956	1562.	57.3	0.533
40.0	0.02717	-181.4	-0.2847	1480.	55.1	0.539
50.0	0.02745	-175.9	-0.2740	1398.	53.0	0.545
60.0	0.02774	-170.4	-0.2633	1319.	50.9	0.552
70.0	0.02804	-164.9	-0.2527	1241.	48.8	0.559
80.0	0.02836	-159.2	-0.2422	1165.	46.8	0.566
90.0	0.02869	-153.5	-0.2317	1092.	44.8	0.574
100.0	0.02903	-147.7	-0.2213	1020.	42.8	0.582
110.0	0.02939	-141.9	-0.2109	950.	40.9	0.591
120.0	0.02978	-135.9	-0.2005	882.	39.0	0.599
130.0	0.03018	-129.9	-0.1902	817.	37.1	0.609
140.0	0.03060	-123.7	-0.1798	753.	35.3	0.618
150.0	0.03106	-117.5	-0.1695	692.	33.4	0.628
160.0	0.03154	-111.1	-0.1592	632.	31.7	0.639
170.0	0.03206	-104.7	-0.1489	575.	29.9	0.650
180.0	0.03261	-98.1	-0.1385	519.	28.2	0.663
190.0	0.03322	-91.4	-0.1281	465.	26.5	0.676
200.0	0.03388	-84.5	-0.1177	413.	24.8	0.690
210.0	0.03460	-77.5	-0.1072	363.	23.1	0.707
220.0	0.03541	-70.4	-0.0965	315.	21.4	0.725
230.0	0.03632	-63.0	-0.0858	269.	19.8	0.747
240.0	0.03737	-55.4	-0.0748	224.	18.1	0.773
250.0	0.03861	-47.5	-0.0636	181.	16.4	0.807
260.0	0.04013	-39.2	-0.0520	140.	14.7	0.854
270.0	0.04209	-30.3	-0.0397	100.3	12.9	0.927
280.0	0.04491	-20.4	-0.0262	62.8	10.9	1.064
290.0	0.05000	-8.1	-0.0098	27.9	8.54	1.464
300.0	0.07245	17.2	0.0236	5.3	4.84	3.811
310.0	0.10427	40.2	0.0538	16.4	3.09	1.468
320.0	0.12084	52.5	0.0697	26.9	2.54	1.065
330.0	0.13310	62.3	0.0822	35.8	2.22	0.915
340.0	0.14326	71.1	0.0932	43.5	2.00	0.838
350.0	0.15217	79.2	0.1033	50.5	1.83	0.791
360.0	0.16021	87.0	0.1128	56.9	1.70	0.761
370.0	0.16762	94.5	0.1219	62.9	1.60	0.740
380.0	0.17456	101.8	0.1307	68.5	1.51	0.726
390.0	0.18111	109.0	0.1392	73.7	1.43	0.715
400.0	0.18735	116.1	0.1476	78.7	1.37	0.708
420.0	0.19910	130.2	0.1637	88.1	1.26	0.699
440.0	0.2101	144.1	0.1794	96.8	1.17	0.695
460.0	0.2205	158.0	0.1947	104.9	1.09	0.694
480.0	0.2304	171.9	0.2096	112.6	1.03	0.696
500.0	0.2400	185.9	0.2243	120.	0.979	0.699
520.0	0.2493	199.9	0.2388	127.	0.932	0.704
540.0	0.2583	214.0	0.2530	134.	0.891	0.709
560.0	0.2671	228.2	0.2671	140.	0.854	0.714
580.0	0.2757	242.6	0.2811	147.	0.821	0.720
600.0	0.2841	257.1	0.2948	153.	0.791	0.727

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

620 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02523	-222.5	-0.3745	2173.	73.1	0.492
-30.0	0.02545	-217.6	-0.3629	2087.	70.8	0.499
-20.0	0.02567	-212.6	-0.3513	2000.	68.6	0.505
-10.0	0.02590	-207.5	-0.3399	1913.	66.3	0.511
0.0	0.02613	-202.4	-0.3287	1826.	64.0	0.516
10.0	0.02638	-197.2	-0.3176	1740.	61.8	0.522
20.0	0.02663	-192.0	-0.3066	1654.	59.6	0.527
30.0	0.02689	-186.7	-0.2957	1570.	57.4	0.533
40.0	0.02716	-181.3	-0.2848	1487.	55.3	0.539
50.0	0.02744	-175.9	-0.2741	1405.	53.1	0.545
60.0	0.02773	-170.4	-0.2634	1326.	51.0	0.552
70.0	0.02803	-164.8	-0.2528	1248.	49.0	0.559
80.0	0.02834	-159.2	-0.2423	1172.	46.9	0.566
90.0	0.02867	-153.5	-0.2318	1098.	44.9	0.574
100.0	0.02901	-147.7	-0.2214	1027.	43.0	0.582
110.0	0.02938	-141.8	-0.2110	957.	41.0	0.590
120.0	0.02976	-135.9	-0.2007	889.	39.1	0.599
130.0	0.03016	-129.8	-0.1903	824.	37.2	0.608
140.0	0.03058	-123.7	-0.1800	760.	35.4	0.618
150.0	0.03103	-117.5	-0.1697	698.	33.6	0.628
160.0	0.03151	-111.1	-0.1594	639.	31.8	0.638
170.0	0.03202	-104.7	-0.1491	581.	30.1	0.650
180.0	0.03257	-98.1	-0.1387	526.	28.3	0.662
190.0	0.03317	-91.4	-0.1284	472.	26.6	0.675
200.0	0.03382	-84.6	-0.1179	420.	24.9	0.689
210.0	0.03454	-77.6	-0.1074	370.	23.3	0.705
220.0	0.03533	-70.5	-0.0969	322.	21.6	0.723
230.0	0.03623	-63.1	-0.0861	276.	20.0	0.744
240.0	0.03725	-55.5	-0.0752	232.	18.3	0.769
250.0	0.03845	-47.7	-0.0641	189.	16.7	0.801
260.0	0.03991	-39.5	-0.0526	148.	14.9	0.844
270.0	0.04175	-30.7	-0.0405	108.8	13.2	0.907
280.0	0.04431	-21.1	-0.0275	71.8	11.3	1.019
290.0	0.04849	-9.8	-0.0123	37.4	9.15	1.282
300.0	0.05971	7.6	0.0107	10.1	6.28	2.535
310.0	0.09074	34.1	0.0454	12.0	3.67	1.883
320.0	0.11005	48.7	0.0643	22.6	2.86	1.197
330.0	0.12337	59.5	0.0780	31.9	2.45	0.980
340.0	0.13406	68.7	0.0896	40.0	2.18	0.878
350.0	0.14324	77.2	0.1002	47.2	1.98	0.818
360.0	0.15145	85.2	0.1100	53.9	1.83	0.781
370.0	0.15895	92.9	0.1193	60.0	1.71	0.756
380.0	0.16593	100.3	0.1282	65.8	1.61	0.738
390.0	0.17249	107.7	0.1369	71.2	1.52	0.725
400.0	0.17871	114.9	0.1453	76.3	1.45	0.716
420.0	0.19038	129.1	0.1616	85.9	1.33	0.705
440.0	0.2013	143.1	0.1774	94.8	1.23	0.700
460.0	0.2115	157.1	0.1928	103.1	1.15	0.698
480.0	0.2213	171.1	0.2078	111.0	1.08	0.699
500.0	0.2307	185.1	0.2226	118.5	1.03	0.702
520.0	0.2398	199.2	0.2371	126.	0.977	0.706
540.0	0.2486	213.3	0.2514	133.	0.933	0.711
560.0	0.2572	227.6	0.2655	139.	0.893	0.716
580.0	0.2656	242.0	0.2795	146.	0.858	0.722
600.0	0.2739	256.5	0.2933	152.	0.826	0.728

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

640 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02523	-222.5	-0.3746	2182.	73.3	0.492
-30.0	0.02544	-217.5	-0.3629	2095.	71.0	0.499
-20.0	0.02566	-212.5	-0.3514	2008.	68.7	0.505
-10.0	0.02589	-207.4	-0.3400	1921.	66.5	0.511
0.0	0.02613	-202.3	-0.3288	1834.	64.2	0.516
10.0	0.02637	-197.2	-0.3177	1747.	62.0	0.522
20.0	0.02662	-191.9	-0.3067	1662.	59.8	0.527
30.0	0.02688	-186.6	-0.2958	1577.	57.6	0.533
40.0	0.02715	-181.3	-0.2849	1494.	55.4	0.539
50.0	0.02742	-175.8	-0.2742	1413.	53.3	0.545
60.0	0.02771	-170.4	-0.2635	1333.	51.2	0.552
70.0	0.02801	-164.8	-0.2529	1255.	49.1	0.559
80.0	0.02833	-159.2	-0.2424	1179.	47.1	0.566
90.0	0.02866	-153.5	-0.2319	1105.	45.1	0.573
100.0	0.02900	-147.7	-0.2215	1033.	43.1	0.581
110.0	0.02936	-141.8	-0.2111	964.	41.2	0.590
120.0	0.02974	-135.8	-0.2008	896.	39.3	0.598
130.0	0.03013	-129.8	-0.1905	830.	37.4	0.608
140.0	0.03055	-123.7	-0.1802	767.	35.6	0.617
150.0	0.03100	-117.4	-0.1699	705.	33.7	0.627
160.0	0.03148	-111.1	-0.1596	646.	32.0	0.638
170.0	0.03199	-104.7	-0.1493	588.	30.2	0.649
180.0	0.03253	-98.1	-0.1389	533.	28.5	0.661
190.0	0.03312	-91.4	-0.1286	479.	26.8	0.673
200.0	0.03377	-84.6	-0.1182	427.	25.1	0.687
210.0	0.03447	-77.7	-0.1077	377.	23.5	0.703
220.0	0.03525	-70.5	-0.0972	329.	21.8	0.720
230.0	0.03613	-63.2	-0.0865	283.	20.2	0.740
240.0	0.03713	-55.7	-0.0756	239.	18.5	0.765
250.0	0.03830	-47.9	-0.0646	197.	16.9	0.795
260.0	0.03970	-39.7	-0.0532	156.	15.2	0.834
270.0	0.04145	-31.1	-0.0413	117.1	13.5	0.891
280.0	0.04380	-21.7	-0.0285	80.5	11.7	0.984
290.0	0.04739	-11.0	-0.0142	46.6	9.66	1.175
300.0	0.05483	3.2	0.0046	18.0	7.23	1.793
310.0	0.07743	26.7	0.0354	9.7	4.46	2.322
320.0	0.09941	44.4	0.0583	18.8	3.25	1.374
330.0	0.11397	56.4	0.0735	28.1	2.71	1.061
340.0	0.12526	66.3	0.0859	36.5	2.38	0.924
350.0	0.13478	75.1	0.0969	44.0	2.15	0.849
360.0	0.14317	83.4	0.1071	50.9	1.97	0.803
370.0	0.15077	91.2	0.1166	57.2	1.83	0.772
380.0	0.15780	98.8	0.1257	63.2	1.72	0.751
390.0	0.16438	106.3	0.1345	68.7	1.62	0.736
400.0	0.17060	113.6	0.1431	74.0	1.54	0.725
420.0	0.18221	127.9	0.1596	83.8	1.40	0.711
440.0	0.19298	142.1	0.1755	92.9	1.30	0.705
460.0	0.2031	156.2	0.1910	101.4	1.21	0.702
480.0	0.2128	170.2	0.2061	109.4	1.14	0.703
500.0	0.2220	184.3	0.2209	117.0	1.08	0.705
520.0	0.2309	198.4	0.2355	124.	1.02	0.709
540.0	0.2396	212.6	0.2498	131.	0.975	0.713
560.0	0.2480	226.9	0.2640	138.	0.933	0.718
580.0	0.2563	241.4	0.2780	145.	0.895	0.724
600.0	0.2643	255.9	0.2918	151.	0.861	0.730

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

660 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02522	-222.4	-0.3747	2190.	73.5	0.492
-30.0	0.02544	-217.5	-0.3630	2104.	71.2	0.499
-20.0	0.02566	-212.5	-0.3515	2017.	68.9	0.505
-10.0	0.02588	-207.4	-0.3401	1929.	66.7	0.511
0.0	0.02612	-202.3	-0.3289	1842.	64.4	0.516
10.0	0.02636	-197.1	-0.3177	1755.	62.2	0.521
20.0	0.02661	-191.9	-0.3067	1669.	59.9	0.527
30.0	0.02687	-186.6	-0.2959	1584.	57.7	0.533
40.0	0.02714	-181.2	-0.2850	1501.	55.6	0.539
50.0	0.02741	-175.8	-0.2743	1420.	53.4	0.545
60.0	0.02770	-170.3	-0.2636	1340.	51.3	0.551
70.0	0.02800	-164.7	-0.2530	1262.	49.3	0.558
80.0	0.02831	-159.1	-0.2425	1186.	47.2	0.566
90.0	0.02864	-153.4	-0.2321	1112.	45.2	0.573
100.0	0.02898	-147.6	-0.2217	1040.	43.3	0.581
110.0	0.02934	-141.8	-0.2113	970.	41.3	0.589
120.0	0.02972	-135.8	-0.2009	903.	39.4	0.598
130.0	0.03011	-129.8	-0.1906	837.	37.5	0.607
140.0	0.03053	-123.7	-0.1803	773.	35.7	0.616
150.0	0.03097	-117.4	-0.1700	712.	33.9	0.626
160.0	0.03145	-111.1	-0.1598	652.	32.1	0.637
170.0	0.03195	-104.7	-0.1495	595.	30.4	0.648
180.0	0.03249	-98.1	-0.1392	539.	28.7	0.660
190.0	0.03308	-91.5	-0.1288	486.	27.0	0.672
200.0	0.03371	-84.7	-0.1184	434.	25.3	0.686
210.0	0.03441	-77.7	-0.1080	385.	23.6	0.701
220.0	0.03518	-70.6	-0.0975	337.	22.0	0.718
230.0	0.03604	-63.3	-0.0868	291.	20.4	0.737
240.0	0.03702	-55.8	-0.0760	246.	18.8	0.760
250.0	0.03815	-48.1	-0.0650	204.	17.1	0.789
260.0	0.03950	-40.0	-0.0537	164.	15.5	0.826
270.0	0.04116	-31.5	-0.0420	125.	13.8	0.877
280.0	0.04334	-22.3	-0.0295	88.9	12.0	0.956
290.0	0.04651	-12.1	-0.0158	55.4	10.1	1.104
300.0	0.05219	0.6	0.0009	26.4	7.94	1.477
310.0	0.06693	19.7	0.0259	10.8	5.37	2.277
320.0	0.08905	39.6	0.0516	15.7	3.73	1.585
330.0	0.10489	53.0	0.0687	24.7	3.01	1.160
340.0	0.11685	63.6	0.0821	33.2	2.60	0.979
350.0	0.12673	72.9	0.0936	40.9	2.33	0.884
360.0	0.13533	81.4	0.1041	48.0	2.12	0.828
370.0	0.14305	89.5	0.1139	54.5	1.96	0.791
380.0	0.15014	97.3	0.1232	60.6	1.83	0.765
390.0	0.15675	104.9	0.1322	66.3	1.72	0.747
400.0	0.16297	112.3	0.1408	71.7	1.63	0.734
420.0	0.17453	126.8	0.1575	81.8	1.48	0.718
440.0	0.18520	141.1	0.1736	91.0	1.37	0.710
460.0	0.19523	155.2	0.1891	99.7	1.27	0.707
480.0	0.2047	169.4	0.2043	107.8	1.19	0.706
500.0	0.2139	183.5	0.2192	115.6	1.13	0.708
520.0	0.2226	197.7	0.2338	123.	1.07	0.711
540.0	0.2311	211.9	0.2482	130.	1.02	0.715
560.0	0.2394	226.3	0.2625	137.	0.974	0.720
580.0	0.2475	240.7	0.2765	144.	0.934	0.725
600.0	0.2554	255.3	0.2904	150.	0.898	0.731

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

680 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02521	-222.4	-0.3748	2199.	73.8	0.492
-30.0	0.02543	-217.4	-0.3631	2112.	71.4	0.499
-20.0	0.02565	-212.4	-0.3516	2025.	69.1	0.505
-10.0	0.02588	-207.3	-0.3402	1937.	66.8	0.511
0.0	0.02611	-202.2	-0.3290	1849.	64.6	0.516
10.0	0.02635	-197.0	-0.3178	1762.	62.3	0.521
20.0	0.02660	-191.8	-0.3068	1676.	60.1	0.527
30.0	0.02686	-186.5	-0.2960	1592.	57.9	0.532
40.0	0.02713	-181.2	-0.2851	1508.	55.7	0.538
50.0	0.02740	-175.7	-0.2744	1427.	53.6	0.545
60.0	0.02769	-170.3	-0.2637	1347.	51.5	0.551
70.0	0.02799	-164.7	-0.2532	1269.	49.4	0.558
80.0	0.02830	-159.1	-0.2426	1193.	47.4	0.565
90.0	0.02863	-153.4	-0.2322	1119.	45.4	0.573
100.0	0.02897	-147.6	-0.2218	1047.	43.4	0.581
110.0	0.02932	-141.7	-0.2114	977.	41.5	0.589
120.0	0.02970	-135.8	-0.2011	909.	39.6	0.598
130.0	0.03009	-129.8	-0.1908	844.	37.7	0.607
140.0	0.03051	-123.6	-0.1805	780.	35.9	0.616
150.0	0.03095	-117.4	-0.1702	719.	34.0	0.626
160.0	0.03142	-111.1	-0.1599	659.	32.3	0.636
170.0	0.03192	-104.7	-0.1497	602.	30.5	0.647
180.0	0.03245	-98.1	-0.1394	546.	28.8	0.659
190.0	0.03303	-91.5	-0.1290	493.	27.1	0.671
200.0	0.03366	-84.7	-0.1187	441.	25.5	0.684
210.0	0.03435	-77.8	-0.1083	391.	23.8	0.699
220.0	0.03511	-70.7	-0.0978	344.	22.2	0.716
230.0	0.03595	-63.4	-0.0872	298.	20.6	0.735
240.0	0.03691	-55.9	-0.0764	254.	19.0	0.757
250.0	0.03801	-48.2	-0.0655	212.	17.4	0.784
260.0	0.03931	-40.2	-0.0543	171.	15.7	0.818
270.0	0.04090	-31.8	-0.0427	133.	14.1	0.864
280.0	0.04294	-22.8	-0.0304	97.2	12.4	0.933
290.0	0.04579	-12.9	-0.0172	63.9	10.5	1.052
300.0	0.05044	-1.3	-0.0017	34.7	8.52	1.307
310.0	0.06046	14.6	0.0190	15.0	6.22	1.909
320.0	0.07946	34.3	0.0445	14.2	4.31	1.768
330.0	0.09618	49.3	0.0636	21.8	3.37	1.273
340.0	0.10881	60.8	0.0780	30.2	2.86	1.042
350.0	0.11907	70.6	0.0902	38.0	2.52	0.924
360.0	0.12789	79.4	0.1011	45.2	2.28	0.855
370.0	0.13575	87.8	0.1111	51.9	2.10	0.811
380.0	0.14291	95.7	0.1207	58.1	1.95	0.781
390.0	0.14955	103.4	0.1298	64.0	1.83	0.760
400.0	0.15578	110.9	0.1386	69.5	1.73	0.745
420.0	0.16730	125.6	0.1555	79.8	1.57	0.725
440.0	0.17789	140.0	0.1717	89.2	1.44	0.715
460.0	0.18781	154.3	0.1874	98.0	1.34	0.711
480.0	0.19720	168.5	0.2026	106.3	1.25	0.710
500.0	0.2062	182.7	0.2176	114.2	1.18	0.711
520.0	0.2148	196.9	0.2323	122.	1.12	0.713
540.0	0.2232	211.2	0.2467	129.	1.06	0.717
560.0	0.2313	225.6	0.2610	136.	1.02	0.722
580.0	0.2392	240.1	0.2750	143.	0.973	0.727
600.0	0.2469	254.7	0.2889	149.	0.935	0.733

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

700 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02521	-222.3	-0.3748	2208.	74.0	0.492
-30.0	0.02542	-217.4	-0.3632	2121.	71.6	0.499
-20.0	0.02564	-212.3	-0.3517	2033.	69.3	0.505
-10.0	0.02587	-207.3	-0.3403	1945.	67.0	0.511
0.0	0.02610	-202.2	-0.3290	1857.	64.7	0.516
10.0	0.02635	-197.0	-0.3179	1770.	62.5	0.521
20.0	0.02659	-191.8	-0.3069	1684.	60.3	0.527
30.0	0.02685	-186.5	-0.2960	1599.	58.1	0.532
40.0	0.02712	-181.1	-0.2852	1515.	55.9	0.538
50.0	0.02739	-175.7	-0.2745	1434.	53.7	0.544
60.0	0.02768	-170.2	-0.2638	1354.	51.6	0.551
70.0	0.02798	-164.7	-0.2533	1276.	49.6	0.558
80.0	0.02829	-159.0	-0.2428	1200.	47.5	0.565
90.0	0.02861	-153.3	-0.2323	1126.	45.5	0.573
100.0	0.02895	-147.6	-0.2219	1054.	43.5	0.580
110.0	0.02930	-141.7	-0.2116	984.	41.6	0.589
120.0	0.02968	-135.8	-0.2012	916.	39.7	0.597
130.0	0.03007	-129.7	-0.1909	850.	37.8	0.606
140.0	0.03048	-123.6	-0.1806	787.	36.0	0.615
150.0	0.03092	-117.4	-0.1704	725.	34.2	0.625
160.0	0.03139	-111.1	-0.1601	666.	32.4	0.635
170.0	0.03188	-104.7	-0.1499	608.	30.7	0.646
180.0	0.03242	-98.2	-0.1396	553.	29.0	0.658
190.0	0.03299	-91.5	-0.1293	499.	27.3	0.670
200.0	0.03361	-84.7	-0.1189	448.	25.6	0.683
210.0	0.03429	-77.8	-0.1085	398.	24.0	0.697
220.0	0.03504	-70.7	-0.0981	351.	22.4	0.714
230.0	0.03587	-63.5	-0.0875	305.	20.8	0.732
240.0	0.03680	-56.1	-0.0768	261.	19.2	0.753
250.0	0.03788	-48.4	-0.0659	219.	17.6	0.779
260.0	0.03913	-40.4	-0.0548	179.	16.0	0.811
270.0	0.04066	-32.1	-0.0433	141.	14.3	0.853
280.0	0.04258	-23.3	-0.0313	105.2	12.7	0.914
290.0	0.04518	-13.7	-0.0184	72.1	10.9	1.012
300.0	0.04915	-2.7	-0.0038	42.9	9.03	1.201
310.0	0.05658	11.2	0.0143	21.0	6.93	1.610
320.0	0.07139	29.3	0.0376	14.4	4.94	1.820
330.0	0.08799	45.4	0.0582	19.7	3.77	1.390
340.0	0.10116	57.8	0.0738	27.5	3.14	1.113
350.0	0.11180	68.1	0.0866	35.3	2.74	0.968
360.0	0.12084	77.4	0.0980	42.6	2.46	0.885
370.0	0.12883	85.9	0.1084	49.4	2.25	0.833
380.0	0.13607	94.1	0.1181	55.7	2.08	0.797
390.0	0.14275	101.9	0.1274	61.7	1.94	0.773
400.0	0.14899	109.6	0.1364	67.3	1.83	0.755
420.0	0.16048	124.5	0.1535	77.8	1.65	0.733
440.0	0.17100	139.0	0.1698	87.4	1.51	0.721
460.0	0.18082	153.4	0.1856	96.4	1.40	0.715
480.0	0.19009	167.6	0.2009	104.8	1.31	0.713
500.0	0.19895	181.9	0.2160	112.8	1.23	0.714
520.0	0.2075	196.2	0.2307	120.	1.17	0.716
540.0	0.2157	210.6	0.2452	128.	1.11	0.719
560.0	0.2236	225.0	0.2595	135.	1.06	0.724
580.0	0.2314	239.5	0.2736	142.	1.01	0.729
600.0	0.2390	254.1	0.2875	148.	0.972	0.734

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

750 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02519	-222.2	-0.3750	2230.	74.5	0.492
-30.0	0.02541	-217.2	-0.3634	2142.	72.1	0.499
-20.0	0.02563	-212.2	-0.3519	2053.	69.8	0.505
-10.0	0.02585	-207.1	-0.3405	1965.	67.5	0.510
0.0	0.02609	-202.0	-0.3293	1876.	65.2	0.516
10.0	0.02633	-196.9	-0.3182	1789.	62.9	0.521
20.0	0.02657	-191.6	-0.3072	1702.	60.7	0.526
30.0	0.02683	-186.4	-0.2963	1617.	58.5	0.532
40.0	0.02709	-181.0	-0.2855	1533.	56.3	0.538
50.0	0.02737	-175.6	-0.2748	1451.	54.1	0.544
60.0	0.02765	-170.1	-0.2641	1371.	52.0	0.550
70.0	0.02795	-164.6	-0.2536	1293.	49.9	0.557
80.0	0.02825	-158.9	-0.2431	1216.	47.9	0.564
90.0	0.02857	-153.2	-0.2326	1142.	45.9	0.572
100.0	0.02891	-147.5	-0.2222	1070.	43.9	0.580
110.0	0.02926	-141.6	-0.2119	1000.	42.0	0.588
120.0	0.02963	-135.7	-0.2016	932.	40.1	0.596
130.0	0.03002	-129.7	-0.1913	867.	38.2	0.605
140.0	0.03042	-123.6	-0.1810	803.	36.4	0.614
150.0	0.03086	-117.4	-0.1708	742.	34.6	0.624
160.0	0.03131	-111.1	-0.1606	682.	32.8	0.634
170.0	0.03180	-104.7	-0.1503	625.	31.1	0.644
180.0	0.03232	-98.2	-0.1401	570.	29.4	0.655
190.0	0.03288	-91.6	-0.1298	516.	27.7	0.667
200.0	0.03349	-84.8	-0.1195	465.	26.0	0.680
210.0	0.03414	-77.9	-0.1092	416.	24.4	0.693
220.0	0.03486	-70.9	-0.0988	368.	22.8	0.709
230.0	0.03566	-63.7	-0.0883	323.	21.2	0.726
240.0	0.03655	-56.4	-0.0777	279.	19.7	0.745
250.0	0.03756	-48.8	-0.0670	237.	18.1	0.768
260.0	0.03873	-41.0	-0.0560	198.	16.5	0.795
270.0	0.04011	-32.8	-0.0448	160.	15.0	0.830
280.0	0.04180	-24.3	-0.0332	125.	13.4	0.877
290.0	0.04396	-15.2	-0.0209	92.0	11.8	0.944
300.0	0.04693	-5.2	-0.0077	62.7	10.1	1.052
310.0	0.05146	6.2	0.0072	38.3	8.30	1.238
320.0	0.05923	20.0	0.0250	22.7	6.48	1.506
330.0	0.07127	35.6	0.0448	19.2	4.96	1.527
340.0	0.08413	49.7	0.0626	23.3	3.98	1.286
350.0	0.09530	61.6	0.0774	29.9	3.37	1.091
360.0	0.10481	71.9	0.0900	36.9	2.96	0.970
370.0	0.11312	81.2	0.1013	43.7	2.66	0.894
380.0	0.12055	89.9	0.1117	50.2	2.44	0.844
390.0	0.12733	98.1	0.1214	56.4	2.26	0.809
400.0	0.13360	106.1	0.1308	62.2	2.11	0.785
420.0	0.14505	121.4	0.1484	73.2	1.88	0.753
440.0	0.15541	136.3	0.1652	83.2	1.71	0.736
460.0	0.16501	151.0	0.1812	92.5	1.57	0.727
480.0	0.17403	165.5	0.1968	101.2	1.46	0.723
500.0	0.18260	179.9	0.2120	109.5	1.37	0.722
520.0	0.19080	194.3	0.2269	117.4	1.29	0.723
540.0	0.19870	208.8	0.2415	125.	1.23	0.725
560.0	0.2064	223.3	0.2559	132.	1.17	0.729
580.0	0.2138	238.0	0.2701	139.	1.12	0.733
600.0	0.2210	252.7	0.2841	146.	1.07	0.738

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

800 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02518	-222.0	-0.3752	2252.	75.0	0.491
-30.0	0.02539	-217.1	-0.3636	2163.	72.6	0.499
-20.0	0.02561	-212.1	-0.3521	2074.	70.3	0.505
-10.0	0.02584	-207.0	-0.3407	1984.	67.9	0.510
0.0	0.02607	-201.9	-0.3295	1895.	65.6	0.515
10.0	0.02631	-196.7	-0.3184	1807.	63.3	0.521
20.0	0.02655	-191.5	-0.3074	1720.	61.1	0.526
30.0	0.02681	-186.2	-0.2965	1635.	58.8	0.531
40.0	0.02707	-180.9	-0.2857	1551.	56.6	0.537
50.0	0.02734	-175.5	-0.2750	1469.	54.5	0.543
60.0	0.02762	-170.0	-0.2644	1388.	52.4	0.550
70.0	0.02792	-164.4	-0.2538	1310.	50.3	0.557
80.0	0.02822	-158.8	-0.2434	1233.	48.2	0.564
90.0	0.02854	-153.1	-0.2329	1159.	46.2	0.571
100.0	0.02887	-147.4	-0.2226	1087.	44.2	0.579
110.0	0.02922	-141.5	-0.2122	1017.	42.3	0.587
120.0	0.02958	-135.6	-0.2019	949.	40.4	0.595
130.0	0.02996	-129.6	-0.1917	883.	38.5	0.604
140.0	0.03037	-123.5	-0.1814	820.	36.7	0.613
150.0	0.03079	-117.3	-0.1712	758.	34.9	0.622
160.0	0.03124	-111.1	-0.1610	699.	33.2	0.632
170.0	0.03172	-104.7	-0.1508	641.	31.4	0.642
180.0	0.03223	-98.2	-0.1406	586.	29.7	0.653
190.0	0.03278	-91.6	-0.1303	533.	28.1	0.664
200.0	0.03337	-84.9	-0.1201	482.	26.4	0.677
210.0	0.03401	-78.0	-0.1098	433.	24.8	0.690
220.0	0.03470	-71.1	-0.0995	385.	23.3	0.704
230.0	0.03547	-63.9	-0.0891	340.	21.7	0.720
240.0	0.03632	-56.6	-0.0786	297.	20.1	0.738
250.0	0.03728	-49.1	-0.0679	255.	18.6	0.758
260.0	0.03837	-41.4	-0.0571	216.	17.1	0.783
270.0	0.03964	-33.4	-0.0461	178.	15.6	0.812
280.0	0.04115	-25.1	-0.0348	143.	14.0	0.850
290.0	0.04302	-16.3	-0.0230	111.0	12.5	0.900
300.0	0.04543	-7.0	-0.0106	81.6	10.9	0.972
310.0	0.04876	3.3	0.0028	56.2	9.34	1.080
320.0	0.05370	14.9	0.0177	36.8	7.72	1.238
330.0	0.06125	28.1	0.0346	26.0	6.19	1.381
340.0	0.07122	42.0	0.0520	24.1	4.97	1.347
350.0	0.08160	54.7	0.0679	27.6	4.13	1.196
360.0	0.09108	66.0	0.0817	33.2	3.56	1.059
370.0	0.09951	76.1	0.0940	39.4	3.15	0.962
380.0	0.10705	85.4	0.1051	45.7	2.85	0.896
390.0	0.11390	94.1	0.1154	51.9	2.61	0.850
400.0	0.12021	102.4	0.1252	57.8	2.42	0.817
420.0	0.13160	118.3	0.1434	69.0	2.14	0.776
440.0	0.14184	133.6	0.1606	79.3	1.92	0.753
460.0	0.15125	148.5	0.1770	88.9	1.76	0.740
480.0	0.16004	163.2	0.1928	97.9	1.63	0.733
500.0	0.16836	177.9	0.2082	106.5	1.52	0.730
520.0	0.17630	192.5	0.2233	114.6	1.43	0.729
540.0	0.18392	207.1	0.2380	122.	1.35	0.731
560.0	0.19129	221.7	0.2525	130.	1.28	0.734
580.0	0.19843	236.4	0.2668	137.	1.22	0.738
600.0	0.2054	251.2	0.2809	144.	1.17	0.742

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

850 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02517	-221.9	-0.3754	2273.	75.6	0.491
-30.0	0.02538	-216.9	-0.3638	2184.	73.1	0.498
-20.0	0.02560	-211.9	-0.3523	2094.	70.7	0.504
-10.0	0.02582	-206.8	-0.3409	2004.	68.4	0.510
0.0	0.02605	-201.7	-0.3297	1915.	66.0	0.515
10.0	0.02629	-196.6	-0.3186	1826.	63.7	0.520
20.0	0.02653	-191.4	-0.3076	1739.	61.5	0.526
30.0	0.02678	-186.1	-0.2968	1653.	59.2	0.531
40.0	0.02705	-180.7	-0.2860	1568.	57.0	0.537
50.0	0.02732	-175.3	-0.2753	1486.	54.9	0.543
60.0	0.02760	-169.9	-0.2647	1405.	52.7	0.549
70.0	0.02789	-164.3	-0.2541	1327.	50.6	0.556
80.0	0.02819	-158.7	-0.2436	1250.	48.6	0.563
90.0	0.02850	-153.0	-0.2332	1176.	46.6	0.570
100.0	0.02883	-147.3	-0.2229	1103.	44.6	0.578
110.0	0.02918	-141.5	-0.2125	1033.	42.6	0.586
120.0	0.02954	-135.6	-0.2023	965.	40.7	0.594
130.0	0.02991	-129.6	-0.1920	899.	38.9	0.603
140.0	0.03031	-123.5	-0.1818	836.	37.1	0.612
150.0	0.03073	-117.3	-0.1716	774.	35.3	0.621
160.0	0.03117	-111.0	-0.1614	715.	33.5	0.630
170.0	0.03164	-104.7	-0.1512	658.	31.8	0.640
180.0	0.03214	-98.2	-0.1411	603.	30.1	0.651
190.0	0.03268	-91.6	-0.1309	549.	28.5	0.662
200.0	0.03325	-84.9	-0.1207	498.	26.8	0.674
210.0	0.03387	-78.1	-0.1104	449.	25.2	0.686
220.0	0.03455	-71.2	-0.1001	402.	23.7	0.700
230.0	0.03529	-64.1	-0.0898	357.	22.1	0.715
240.0	0.03610	-56.9	-0.0794	314.	20.6	0.731
250.0	0.03701	-49.4	-0.0688	273.	19.1	0.750
260.0	0.03804	-41.8	-0.0582	233.	17.6	0.772
270.0	0.03922	-34.0	-0.0473	196.	16.1	0.798
280.0	0.04060	-25.8	-0.0363	162.	14.7	0.829
290.0	0.04226	-17.3	-0.0249	129.	13.2	0.869
300.0	0.04431	-8.3	-0.0130	99.8	11.7	0.922
310.0	0.04698	1.2	-0.0004	73.9	10.2	0.995
320.0	0.05060	11.7	0.0130	52.5	8.72	1.094
330.0	0.05573	23.3	0.0278	37.5	7.27	1.208
340.0	0.06277	35.8	0.0435	30.0	5.99	1.271
350.0	0.07120	48.4	0.0592	29.1	4.98	1.225
360.0	0.07984	60.2	0.0736	32.1	4.25	1.122
370.0	0.08799	70.9	0.0867	37.0	3.72	1.024
380.0	0.09544	80.8	0.0985	42.6	3.32	0.948
390.0	0.10226	90.0	0.1094	48.5	3.02	0.892
400.0	0.10854	98.7	0.1196	54.3	2.78	0.852
420.0	0.11986	115.2	0.1385	65.4	2.42	0.800
440.0	0.12996	130.8	0.1561	75.9	2.16	0.770
460.0	0.13919	146.1	0.1729	85.7	1.96	0.753
480.0	0.14778	161.0	0.1889	95.0	1.81	0.743
500.0	0.15587	175.8	0.2045	103.7	1.68	0.738
520.0	0.16357	190.6	0.2197	112.0	1.57	0.737
540.0	0.17094	205.3	0.2346	120.0	1.48	0.737
560.0	0.17805	220.1	0.2492	128.	1.40	0.739
580.0	0.18494	234.9	0.2636	135.	1.34	0.742
600.0	0.19163	249.7	0.2778	142.	1.28	0.746

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

900 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02515	-221.7	-0.3756	2295.	76.1	0.491
-30.0	0.02536	-216.8	-0.3640	2204.	73.6	0.498
-20.0	0.02558	-211.8	-0.3525	2114.	71.2	0.504
-10.0	0.02580	-206.7	-0.3411	2023.	68.8	0.510
0.0	0.02603	-201.6	-0.3299	1933.	66.5	0.515
10.0	0.02627	-196.4	-0.3188	1844.	64.1	0.520
20.0	0.02651	-191.2	-0.3079	1757.	61.9	0.525
30.0	0.02676	-186.0	-0.2970	1670.	59.6	0.531
40.0	0.02702	-180.6	-0.2862	1586.	57.4	0.536
50.0	0.02729	-175.2	-0.2755	1503.	55.2	0.542
60.0	0.02757	-169.7	-0.2649	1422.	53.1	0.549
70.0	0.02786	-164.2	-0.2544	1343.	51.0	0.555
80.0	0.02816	-158.6	-0.2439	1267.	48.9	0.562
90.0	0.02847	-152.9	-0.2335	1192.	46.9	0.570
100.0	0.02879	-147.2	-0.2232	1120.	44.9	0.577
110.0	0.02913	-141.4	-0.2129	1049.	43.0	0.585
120.0	0.02949	-135.5	-0.2026	981.	41.1	0.593
130.0	0.02986	-129.5	-0.1924	916.	39.2	0.602
140.0	0.03026	-123.4	-0.1822	852.	37.4	0.610
150.0	0.03067	-117.3	-0.1720	790.	35.6	0.620
160.0	0.03110	-111.0	-0.1618	731.	33.9	0.629
170.0	0.03157	-104.7	-0.1517	674.	32.1	0.639
180.0	0.03206	-98.2	-0.1415	619.	30.5	0.649
190.0	0.03258	-91.7	-0.1314	566.	28.8	0.660
200.0	0.03314	-85.0	-0.1212	515.	27.2	0.671
210.0	0.03375	-78.2	-0.1110	466.	25.6	0.683
220.0	0.03440	-71.3	-0.1008	419.	24.1	0.696
230.0	0.03512	-64.3	-0.0905	374.	22.5	0.710
240.0	0.03590	-57.1	-0.0801	331.	21.0	0.726
250.0	0.03677	-49.7	-0.0697	290.	19.6	0.743
260.0	0.03774	-42.2	-0.0592	251.	18.1	0.763
270.0	0.03885	-34.4	-0.0485	214.	16.7	0.785
280.0	0.04012	-26.4	-0.0376	179.	15.2	0.812
290.0	0.04162	-18.1	-0.0264	147.	13.8	0.845
300.0	0.04342	-9.4	-0.0150	117.5	12.4	0.887
310.0	0.04566	-0.3	-0.0030	91.1	11.0	0.940
320.0	0.04855	9.5	0.0096	68.7	9.56	1.009
330.0	0.05239	20.0	0.0230	51.2	8.20	1.091
340.0	0.05750	31.3	0.0372	39.7	6.94	1.163
350.0	0.06393	43.1	0.0519	34.5	5.85	1.183
360.0	0.07119	54.8	0.0663	34.2	4.99	1.139
370.0	0.07858	65.9	0.0797	37.0	4.34	1.064
380.0	0.08565	76.2	0.0920	41.3	3.85	0.992
390.0	0.09227	85.8	0.1034	46.4	3.47	0.932
400.0	0.09844	94.9	0.1140	51.7	3.17	0.886
420.0	0.10958	111.9	0.1336	62.6	2.72	0.824
440.0	0.11952	128.0	0.1517	73.0	2.41	0.788
460.0	0.12857	143.6	0.1688	83.0	2.18	0.766
480.0	0.13696	158.8	0.1851	92.3	1.99	0.754
500.0	0.14485	173.8	0.2009	101.2	1.85	0.747
520.0	0.15233	188.7	0.2163	109.7	1.72	0.744
540.0	0.15948	203.5	0.2313	117.8	1.62	0.743
560.0	0.16636	218.4	0.2461	126.	1.53	0.744
580.0	0.17300	233.3	0.2605	133.	1.45	0.747
600.0	0.17946	248.3	0.2748	140.	1.39	0.750

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

950 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02514	-221.6	-0.3758	2316.	76.6	0.491
-30.0	0.02535	-216.6	-0.3642	2225.	74.1	0.498
-20.0	0.02557	-211.6	-0.3527	2134.	71.7	0.504
-10.0	0.02579	-206.6	-0.3413	2043.	69.3	0.509
0.0	0.02601	-201.5	-0.3301	1952.	66.9	0.514
10.0	0.02625	-196.3	-0.3191	1863.	64.5	0.520
20.0	0.02649	-191.1	-0.3081	1775.	62.2	0.525
30.0	0.02674	-185.8	-0.2972	1688.	60.0	0.530
40.0	0.02700	-180.5	-0.2865	1603.	57.8	0.536
50.0	0.02727	-175.1	-0.2758	1520.	55.6	0.542
60.0	0.02754	-169.6	-0.2652	1439.	53.4	0.548
70.0	0.02783	-164.1	-0.2547	1360.	51.3	0.555
80.0	0.02813	-158.5	-0.2442	1283.	49.3	0.562
90.0	0.02844	-152.8	-0.2338	1208.	47.2	0.569
100.0	0.02876	-147.1	-0.2235	1136.	45.3	0.577
110.0	0.02909	-141.3	-0.2132	1065.	43.3	0.584
120.0	0.02945	-135.4	-0.2029	997.	41.4	0.592
130.0	0.02982	-129.4	-0.1927	932.	39.6	0.601
140.0	0.03020	-123.4	-0.1826	868.	37.7	0.609
150.0	0.03061	-117.2	-0.1724	806.	35.9	0.618
160.0	0.03104	-111.0	-0.1623	747.	34.2	0.627
170.0	0.03149	-104.6	-0.1521	690.	32.5	0.637
180.0	0.03198	-98.2	-0.1420	635.	30.8	0.647
190.0	0.03249	-91.7	-0.1319	582.	29.2	0.658
200.0	0.03304	-85.0	-0.1217	531.	27.6	0.669
210.0	0.03363	-78.3	-0.1116	482.	26.0	0.680
220.0	0.03426	-71.4	-0.1014	435.	24.5	0.693
230.0	0.03496	-64.4	-0.0912	390.	23.0	0.706
240.0	0.03571	-57.3	-0.0809	347.	21.5	0.721
250.0	0.03654	-50.0	-0.0705	306.	20.0	0.737
260.0	0.03747	-42.5	-0.0601	267.	18.6	0.755
270.0	0.03851	-34.8	-0.0495	231.	17.1	0.775
280.0	0.03969	-27.0	-0.0388	196.	15.7	0.799
290.0	0.04106	-18.8	-0.0279	164.	14.4	0.827
300.0	0.04268	-10.4	-0.0167	135.	13.0	0.860
310.0	0.04463	-1.5	-0.0052	108.0	11.6	0.902
320.0	0.04705	7.8	0.0068	84.8	10.3	0.953
330.0	0.05012	17.6	0.0194	65.7	9.01	1.013
340.0	0.05405	28.1	0.0326	51.6	7.78	1.074
350.0	0.05900	39.1	0.0462	42.9	6.68	1.115
360.0	0.06484	50.3	0.0600	39.3	5.75	1.114
370.0	0.07120	61.3	0.0733	39.4	5.00	1.074
380.0	0.07763	71.8	0.0859	42.0	4.41	1.018
390.0	0.08385	81.7	0.0976	45.9	3.96	0.963
400.0	0.08977	91.1	0.1086	50.5	3.59	0.916
420.0	0.10062	108.7	0.1288	60.6	3.06	0.848
440.0	0.11034	125.2	0.1474	70.8	2.68	0.806
460.0	0.11920	141.1	0.1648	80.7	2.41	0.780
480.0	0.12740	156.5	0.1814	90.1	2.19	0.765
500.0	0.13508	171.7	0.1974	99.1	2.02	0.756
520.0	0.14235	186.8	0.2130	107.7	1.88	0.751
540.0	0.14929	201.8	0.2281	116.0	1.76	0.749
560.0	0.15596	216.8	0.2430	124.	1.66	0.750
580.0	0.16239	231.8	0.2576	132.	1.58	0.751
600.0	0.16863	246.8	0.2719	139.	1.50	0.754

TABLE 5C (CONT.) THERMODYNAMIC PROPERTIES OF THE 0.1 MOLE FRACTION ISOPENTANE IN ISOBUTANE MIXTURE ON ISOBARS AT SUPERCRITICAL PRESSURES.

1000 PSIA

T DEG F	V FT3/LB	H BTU/LB	S BTU/(LB-F)	DP/DD	DP/DT	CP BTU/(LB-F)
-40.0	0.02512	-221.4	-0.3760	2337.	77.1	0.491
-30.0	0.02533	-216.5	-0.3644	2245.	74.6	0.498
-20.0	0.02555	-211.5	-0.3529	2153.	72.1	0.504
-10.0	0.02577	-206.4	-0.3416	2062.	69.7	0.509
0.0	0.02600	-201.3	-0.3303	1971.	67.3	0.514
10.0	0.02623	-196.2	-0.3193	1881.	64.9	0.519
20.0	0.02647	-191.0	-0.3083	1793.	62.6	0.525
30.0	0.02672	-185.7	-0.2975	1706.	60.3	0.530
40.0	0.02698	-180.4	-0.2867	1620.	58.1	0.536
50.0	0.02724	-175.0	-0.2760	1537.	55.9	0.542
60.0	0.02752	-169.5	-0.2654	1456.	53.8	0.548
70.0	0.02780	-164.0	-0.2549	1376.	51.7	0.554
80.0	0.02810	-158.4	-0.2445	1299.	49.6	0.561
90.0	0.02840	-152.7	-0.2341	1225.	47.6	0.568
100.0	0.02872	-147.0	-0.2238	1152.	45.6	0.576
110.0	0.02906	-141.2	-0.2135	1082.	43.6	0.584
120.0	0.02940	-135.3	-0.2033	1013.	41.7	0.591
130.0	0.02977	-129.4	-0.1931	947.	39.9	0.600
140.0	0.03015	-123.3	-0.1829	884.	38.1	0.608
150.0	0.03055	-117.2	-0.1728	822.	36.3	0.617
160.0	0.03098	-110.9	-0.1627	763.	34.5	0.626
170.0	0.03142	-104.6	-0.1526	706.	32.8	0.636
180.0	0.03190	-98.2	-0.1425	651.	31.2	0.645
190.0	0.03240	-91.7	-0.1324	598.	29.5	0.656
200.0	0.03294	-85.1	-0.1223	547.	27.9	0.666
210.0	0.03351	-78.3	-0.1121	498.	26.4	0.677
220.0	0.03413	-71.5	-0.1020	451.	24.8	0.689
230.0	0.03480	-64.5	-0.0918	406.	23.3	0.702
240.0	0.03553	-57.4	-0.0816	364.	21.9	0.716
250.0	0.03633	-50.2	-0.0713	323.	20.4	0.731
260.0	0.03721	-42.8	-0.0610	284.	19.0	0.748
270.0	0.03820	-35.2	-0.0505	247.	17.6	0.766
280.0	0.03931	-27.4	-0.0399	213.	16.2	0.787
290.0	0.04058	-19.4	-0.0292	181.	14.9	0.811
300.0	0.04205	-11.2	-0.0182	151.	13.6	0.840
310.0	0.04379	-2.6	-0.0070	125.	12.3	0.874
320.0	0.04588	6.4	0.0045	100.8	11.0	0.914
330.0	0.04844	15.8	0.0165	80.6	9.73	0.960
340.0	0.05162	25.7	0.0289	64.7	8.54	1.009
350.0	0.05556	36.0	0.0418	53.4	7.44	1.051
360.0	0.06026	46.6	0.0548	46.8	6.48	1.070
370.0	0.06557	57.3	0.0678	44.3	5.66	1.059
380.0	0.07121	67.8	0.0803	44.7	5.00	1.025
390.0	0.07689	77.8	0.0922	47.1	4.47	0.981
400.0	0.08243	87.4	0.1034	50.7	4.05	0.938
420.0	0.09283	105.5	0.1242	59.6	3.42	0.869
440.0	0.10227	122.4	0.1432	69.3	2.98	0.823
460.0	0.11091	138.6	0.1609	78.9	2.65	0.794
480.0	0.11890	154.2	0.1778	88.3	2.41	0.776
500.0	0.12639	169.7	0.1940	97.4	2.21	0.765
520.0	0.13346	184.9	0.2098	106.0	2.05	0.759
540.0	0.14020	200.0	0.2251	114.4	1.92	0.756
560.0	0.14667	215.1	0.2400	122.	1.80	0.755
580.0	0.15290	230.2	0.2547	130.	1.70	0.756
600.0	0.15894	245.4	0.2691	138.	1.62	0.758

```
C THIS IS A MAIN PROGRAM TO CALCULATE THE THERMODYNAMIC PROPERTIES OF AN
C  ISOBUTANE-ISOPENTANE MIXTURE ON AN ISOBAR. THE USER IS QUERIED AS TO
C  CHOICE OF UNITS AND THEN ASKED FOR X, P, INITIAL T, FINAL T AND INCREMENT
C  OF T.  THE OUTPUT WILL CONTAIN X, DENS, TEMPERATURE, PRESSURE, DP/DT,
C  DP/DD, CV, CP, S, H AND U.
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /PROPS/ P,A,G,H,U,S,CV,CP,DPDD,DPDT,W
      COMMON /CRITC / PC4,PC5,DC4,DC5,TC4,TC5,PI4,PI5,DI4,DI5,TI4,TI5
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VX,TX
      COMMON /DERIVS/ DADT,CVR,DPDTR,D2P
      COMMON /QQQQ/ Q,ARES,QAB,Q10,Q20,Q11,QUB,QSB,CVB,DPDTB,DPDDB
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX,WMR
      CHARACTER*6 ND,NH
      COMMON /UNITS/ IX,IT,ID,IP,IH,NT,ND,NP,NH,FT,FD,FP,FH,IFLAG
      CHARACTER*1 IFLAG
      CALL SETUP
    1 READ(5,*,END=9) XX,PIN,T1,T2,TI
      X=XX
      IF(IX.NE.1) X=XX/(XX+(1.-XX)*WMR)
      TT=T1-TI
      CALL FACTOR(X,1.D0,1.D0)
      FDD=FD
      IF(ID.NE.3) FDD=FD/WMX
      FHH=FH
      IF(ID.NE.3) FHH=FH*WMX
      PP = PIN*FP/PR/QX
      DDD = 3.
    2 TT=TT+TI
      IF(TT.GT.T2) GO TO 1
      T=TTT(TT)/FX
      PSAT=PS(T)
      IF(DDD.GT.1. .AND. PP.LT.PSAT) DDD=PP/RSS/T
      CALL BB(T)
      CALL DFIND(D,PP,DDD,T,DQ)
      DDD=D
      CALL FACTOR(X,D,T)
      T=TTT(TT)/FX
      PP = PIN*FP/PR/QX
      CALL DFIND(D,PP,DDD,T,DQ)
      DDD=D
      CALL THERM(D,T,X)
      PPP = P/FP *PR
      DD = D*DR/FDD/HX
      DPDT = DPDT*FT/FP *PR/TR
      DPDD = DPDD*FDD/FP *PR/DR
      CV = CV*FT/FHH *SR
      CP = CP*FT/FHH *SR
      S = S*FT/FHH *SR
      H = H/FHH *AR
      U = U/FHH *AR
      A=A/FHH *AR
      G=G/FHH *AR
      WRITE(6,3) IFLAG,X,DD,TT,PPP,DPDT,DPDD,CV,CP,S,H,U
    3 FORMAT(1X,A1,F5.2,F9.3,F8.2,F10.5,2F10.6,3F10.6,4F12.5)
      GO TO 2
    9 STOP
      END
```

```
      BLOCK DATA
C ALL COEFFICIENTS AND PARAMETERS OF THE HELMHOLTZ FUNCTION ARE
C  CONTAINED HERE.
      IMPLICIT REAL*8(A-H,O-Z)
      REAL*4 TBT,A5BT,S5BT,CV5BT,TCT,G5CT,S5CT,CP5CT
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX,WMR
      COMMON /NCONST/G(25),AA,MM(25),NN(25),NC
      COMMON /BCONST/ B1(12),B2(12)
      COMMON /CRITC / PC4,PC5,DC4,DC5,TC4,TC5,PI4,PI5,DI4,DI5,TI4,TI5
      COMMON /IDEAL5/ TBT(16),A5BT(16),S5BT(16),CV5BT(16),TCT(16)
     1,G5CT(16),S5CT(16),CP5CT(16)
      COMMON /IDEAL4/ C4C(11)
      COMMON /CONVRT/ FFP(6),FFD(6),FFT(6),FFH(6)
      DATA PR,DR,TR/3.629D6,3879.6D0,407.84D0/
C THE CONVERSION FACTORS FOR DIFFERENT SYSTEMS OF UNITS ARE AS
C   RECOMMENDED BY THE ASTM IN THEIR 'STANDARD FOR METRIC PRACTICE'
C   (STANDARD E380-79).
      DATA FFP/1.D6,1.D5,1.01325D5,6894.757D0,2*1.D0/
      DATA FFD/1.D0,2*1.D3,16.01846D0,2*0.D0/
      DATA FFH/2*1.D3,4.184D3,2.324444D3,2*1.D0/
C THE ABOVE CONVERSION FACTORS FOR THE CAL AND BTU ARE THE
C   'THERMOCHEMICAL' CAL AND BTU.
      DATA TI4,PI4,DI4/407.84D0,3.629D6,3879.6D0/
      DATA TI5,PI5,DI5/460.51D0,3.3707D6,3247.3D0/
      DATA C4C/-5.0937093D-2,2.5252496D0,346.6523555D0,2.551551D0
     1,-53.012165D0,3.3434600D0,-.11945060D0,-38.124442D0
     2,7.9688113D0,27.849029D0,58.1382356D0/
     *, WM4,WM5,R/58.1242D-3,72.1512D-3,8.31441D0/, AA/.38796166D0/
C THE VALUES USED FOR M4, M5 AND R  ARE THOSE RECOMMENDED BY COHEN AND
C   TAYLOR IN 'THE 1973 LEAST-SQUARES ADJUSTMENT OF THE FUMDAMENTAL
C   CONSTANTS', JPCRD VOL 2 P 663 (1973).
C THE FOLLOWING TABLE OF THE IDEAL GAS PROPERTIES FOR ISOPENTANE ARE FROM
C   SCOTT, BUR OF MINES BULLETIN 666 (1974).
      DATA TCT/.01,2.E2,273.15,3.E2,4.E2,5.E2,6.E2,7.E2,8.E2,9.E2
     1,1.E3,1.1E3,1.2E3,1.3E3,1.4E3,1.5E3/
      DATA G5CT/0.,-58.16,-62.98,-64.59,-70.20,-75.38,-80.3
     1,-85.0,-89.5,-93.9,-98.1,-102.2,-106.1,-109.9,-113.6,-117.1/
      DATA S5CT/0.,72.50,79.72,82.30,91.63,100.57,109.1
     1,117.3,125.0,132.4,139.4,146.1,152.4,158.5
     2,164.3,169.8/,CP5CT/0.,20.30,26.38,28.56,36.54
     3,43.80,50.2,55.7,60.5,64.7,68.4,71.6,74.4,77.,79.,81./
      DATA G/ -.96153074D1,   .27935713D2, -.12569635D3,   .54406550D3
     *,   -.47948565D3,    .14134133D3,   -.12372626D2,   -.34731447D2
     *,   -.57569010D3,    .53210066D3,    .41502454D3,   -.42359614D3
     *,    .58118955D2,   -.50009149D2,    .23153999D3,   -.38080769D3
     *,    .26120687D3,   -.22934154D2,   -.14503027D2,   -.10167777D2
     *,    .30142576D2,   -.33549797D2,    .25502886D2,   -.53441617D0
     *,   .37213690D-1/,NC/25/
      DATA MM/1,2,4,5,6,8,1,3,5,6,7,8,1,2,4,6,8,1,6,1,2,5,8,2,8/
      DATA NN/2,2,2,2,2,2,3,3,3,3,3,3,4,4,4,4,4,5,5,6,6,6,6,7,7/
      DATA B1/.15386314D0,-.03916987D0,3*0.D0,-2.5198404D-4,3*0.D0
     *,9.8801205D-7,2*0.D0/, B2/3.0020353D0,0.D0,-6.1529971D0,0.D0
     *,-1.4570002D0,0.D0,.13342155D0,4*0.D0,-9.004371D-5/
      END
```

```
      SUBROUTINE SETUP
C THIS SUBROUTINE QUERIES THE USER FOR CHOICE OF UNITS AND SETS UP THE
C  CONVERSION FACTORS, AND ALSO CALCULATES SOME DERIVED PARAMETERS.
      IMPLICIT REAL*8  (A-H,O-Z)
      COMMON /UNITS/ IX,IT,ID,IP,IH,NT,ND,NP,NH,FT,FD,FP,FH
      COMMON /CRITC / PC4,PC5,DC4,DC5,TC4,TC5,PI4,PI5,DI4,DI5,TI4,TI5
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX,WMR
      COMMON /CONVRT/ FFP(6),FFD(6),FFT(6),FFH(6)
      CHARACTER*6 NND(4),ND,NH
      DIMENSION NNT(4),NNP(4)
      DATA NNT/1HK,1HC,1HR,1HF/
      DATA NND/6HKG/M3 ,6HG/CM3 ,6HMOL/L ,6HLB/FT3/
      DATA NNP/3HMPA,3HBAR,3HATM,3HPSI/
      WRITE(6,12)
      READ(5,*) IT
      IF(IT-3) 102,105,105
  102 WRITE(6,13)
      READ(5,*) ID
      WRITE(6,14)
      READ(5,*) IP
      WRITE(6,15)
      READ(5,*) IH
      GO TO 109
  105 ID=4
      IP=4
      IH=4
  109 NP=NNP(IP)
      FP=FFP(IP)
      NT=NNT(IT)
      ND=NND(ID)
      FD=FFD(ID)
      FH=FFH(IH)
      IX=1
      IF(ID.EQ.3) GO TO 110
      WRITE(6,16)
      READ(5,*) IX
  110 WMR = WM5/WM4
      AR = PR/DR
      SR = AR/TR
      WR = (1.D3*AR)**(.5)
      RSS = R/SR
      CALL FZ5GEN
      PC4 = PI4/PR
      DC4 = DI4/DR
      TC4 = TI4/TR
      PC5 = PI5/PR
      DC5 = DC4 * TI4/TI5 *PI5/PI4
      TC5 = TI5/TR
      RETURN
   11 FORMAT(' ENTER UNITS CHOSEN FOR ',2A6)
   12 FORMAT(' CHOOSE FROM 1=DEG K, 2=DEG C, 3=DEG R, 4=DEG F')
   13 FORMAT(' CHOOSE FROM 1=KG/M3, 2=G/CM3, 3=MOL/L, 4=LB/FT3')
   14 FORMAT(' CHOOSE FROM 1=MPA, 2=BAR, 3=ATM, 4=PSIA')
   15 FORMAT(' CHOOSE FROM 1=KJ/KG, 2=J/G, 3=CAL/G, 4=BTU/LB')
   16 FORMAT(' CONCENTRATIONS IN: 1 MOLE FRAC, OR 2 WEIGHT FRAC?')
      END
```

```
      FUNCTION TTT(T)
C FUNCTION TO CONVERT INPUT TEMPERATURES IN EXTERNAL UNITS TO DEG K
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      CHARACTER*6 ND,NH
      COMMON /UNITS/ IX,IT,ID,IP,IH,NT,ND,NP,NH,FT,FD,FP,FH
      GO TO (1,2,3,4),IT
    1 TTT=T/TR
      FT=1.DO
      RETURN
    2 TTT=T+273.15DO
      FT=1.DO
      TTT=TTT/TR
      RETURN
    3 TTT=T/1.8DO
      FT=5.DO/9.DO
      TTT=TTT/TR
    4 TTT=(T+459.67DO)/1.8DO
      FT=5.DO/9.DO
      TTT=TTT/TR
      RETURN
      END
CC
      FUNCTION TTI(T)
C FUNCTION TO CONVERT INTERNAL TEMPERATURES IN DEG K TO EXTERNAL UNITS
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      CHARACTER*6 ND,NH
      COMMON /UNITS/ IX,IT,ID,IP,IH,NT,ND,NP,NH,FH
      GO TO (5,6,7,8),IT
    5 TTI = T*TR
      RETURN
    6 TTI = T*TR-273.15
      RETURN
    7 TTI = T*TR*1.8DO
      RETURN
    8 TTI = T*TR*1.8DO - 459.67
      RETURN
      END
CC
      SUBROUTINE BB(T)
      IMPLICIT REAL*8  (A-H,O-Z)
      COMMON /ELLCON/ BB1,BB2,BB1T,BB2T,BB1TT,BB2TT
      COMMON /BCONST/ P(12),Q(12),NVIR,NVOL
      DIMENSION V(12)
      V(1)=1.
    1 DO 2 I=2,12
    2 V(I)=V(I-1)/T
      BB1=P(1)-P(2)*DLOG(V(2))
      BB2=Q(1)
      BB1T=P(2)
      BB2T=0.
      BB1TT=-P(2)
      BB2TT=0.
      DO 4 I=3,12
      BB1=BB1+P(I)*V(I-1)
      BB2=BB2+Q(I)*V(I-1)
      BB1T=BB1T-(I-2)*P(I)*V(I-1)
      BB2T=BB2T-(I-2)*Q(I)*V(I-1)
      BB1TT=BB1TT+P(I)*(I-2)*(I-1)*V(I-1)
    4 BB2TT=BB2TT+Q(I)*(I-2)*(I-1)*V(I-1)
      END
```

```
CC
      FUNCTION PBASE(D,T)
C HERE THE CONTRIBUTIONS OF THE A1 AND A2 PARTS OF THE REFERENCE FUNCTION
C  ARE COMPUTED, ALONG WITH DERIVITAVES NEEDED IN OTHER FUNCTIONS.
      IMPLICIT REAL*8  (A-H,O-Z)
      COMMON /QQQQ/ Q0,Q1,QAB,Q3,Q4,Q5,QUB,QSB,QCVB,DPDTB,DPDDB
      COMMON/ELLCON/ B1,B2,B1T,B2T,B1TT,B2TT
      COMMON /RCONST/ TRR,PRR,DRR,ARR,SRR,WRR,R,RSS,WM4,WM5,WMX
      Y=B1*D
      X=1.-Y
      DPDDB = RSS*T*(9.*Y*Y/X**4 + Y/X/X - 1./X)
      QAB = D*T*B2 + RSS*T*(DLOG(D/X)+1.5/X/X-4.*D*B1)
      PBASE = T*B2 + RSS*T/D*(1./X+3.*Y/X**3-4.*Y)
      PBASE = PBASE*D*D
      QSB =-QAB/T - D*B2T - RSS*D*B1T*(1./X+3./X**3-4.)
      QUB = QAB + T*QSB
      QCVB = -2.*D*B2T -D*B2TT -RSS*D*((1./X+3./X**3-4.)*(2.*B1T+B1TT)
     1 +D*(1./X/X+9./X**4)*B1T*B1T)
      DPDTB = PBASE/T + D*D*(B2T+RSS*(1./X/X+3./X**3+9.*Y/X**4-4.)*B1T)
      RETURN
      END
CC
      SUBROUTINE QQ(T,D)
C THIS SUBROUTINE COMPUTES THE CONTRIBUTIONS OF THE A4 PART OF THE
C  REFERENCE FUNCTION AND ITS DERIVATIVES.
      IMPLICIT REAL*8  (A-H,O-Z)
      COMMON /QQQQ/ Q,ARES,Q02,Q10,Q20,Q11,Q7,Q8,Q9,Q010,DPDDB
      COMMON /NCONST/ A(25),AA,II(25),JJ(25),N
      COMMON /RCONST/ TRR,PRR,DRR,ARR,SRR,WRR,R,RSS,WM4,WM5,WMX
      COMMON/DERIVS/ DADT,D2A,DPDT,D2P
      DADT=0.
      D2P=0.
      D2A=0.
      DPDT=0.
      Q=0.D0
      ARES=0.D0
      Q11=0.D0
      E=DEXP(-AA*D)
      Q10=D*D*E
      Q20=1.D0-E
      XX=DABS(AA*D)
      IF(XX.LT.1.D-5) Q20=AA*D
      DO 10 I=1,N
      K=II(I)
      L=JJ(I)
      ZZ=K+1
      FCT=AA*ZZ*Q10*Q20**K*T**(1-L)
      DFCT=AA*AA*Q10*T**(1-L)*ZZ*Q20**(K-1)*(K-ZZ*Q20)
      DFDT=Q20**(K+1)*(1-L)*T**(-L)
      D2F=L*DFDT
      DPT=DFDT*Q10*AA*ZZ/Q20
      D2PA=L*DPT
      DADT=DADT+A(I)*DFDT
      DPDT=DPDT+A(I)*DPT
      D2A=D2A+A(I)*D2F
      D2P=D2P+A(I)*D2PA
      B=A(I)*FCT
      Q11 = Q11 + A(I)*DFCT
      Q = Q + B
      Y=Q20/AA/Q10/ZZ
      ARES = ARES + B*Y
   10 CONTINUE
      RETURN
      END
```

```
CC
      SUBROUTINE FZ4(TT,AZ,SZ,CVZ)
C THIS IS THE AO FUNCTION FOR PURE ISOBUTANE AND ITS DERIVATIVES.
      IMPLICIT REAL*8  (A-H,O-Z)
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX,WMR
      COMMON /IDEAL4/ C(11)
      U=C(9)/TT
      Y=DEXP(U)
      SZ=C(8)*(U*Y/(Y-1.)-DLOG(Y-1.))-C(10)/TT-C(11)*(DLOG(TT)+1.)
      AZ=C(8)*TT*DLOG(Y-1.)+(C(10)+C(11)*TT)*DLOG(TT)
      CVZ = C(10)/TT-C(11)+C(8)*U*U*Y/(Y-1.)**2
      DO 8 I=1,7
      CVZ=CVZ-C(I)*(I-3)*(I-4)*TT**(I-4)
      AZ=AZ+C(I)*TT**(I-3)
    7 SZ=SZ-C(I)*TT**(I-4)*(I-3)
    8 CONTINUE
      RETURN
      END
C
      SUBROUTINE FZ5(TT,AZ,SZ,CVZ)
C THIS IS THE AO FUNCTION FOR PURE ISOPENTANE AND ITS DERIVATIVES.
      REAL*8 TT,AZ,SZ,CVZ
      COMMON /IDEAL5/ TBT(16),A5BT(16),S5BT(16),CV5BT(16),CALTAB(64)
      TK=TT
      IB=1
      DO 2 I=3,14
      IF(TT.LT.TBT(I)) GO TO 3
   2  IB=IB+1
   3  CALL INTRPL(TBT(IB),A5BT(IB),4,TK,AI)
      CALL INTRPL(TBT(IB),S5BT(IB),4,TK,SI)
      CALL INTRPL(TBT(IB),CV5BT(IB),4,TK,CVI)
      AZ = AI - 35.1874288D0 + TK*145.188298D0
      SZ = SI - 145.188298D0
      CVZ = CVI
      RETURN
      END
C
      SUBROUTINE FZ5GEN
C THIS SUBROUTINE CONVERTS THE ORIGINAL SCOTT TABLE OF ISOPENTANE
C  IDEAL GAS FUNCTIONS TO DIMENSIONLESS UNITS.
      REAL*8 TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      COMMON/IDEAL5/TB(16),AB(16),SB(16),CVB(16),T(16),G(16),S(16),C(16)
      Q = 4.184
      RC = R/Q
      DO 8 I=1,16
      AB(I) = (G(I)-RC*(1.-ALOG(T(I))))*T(I)*Q/AR
      SB(I) = (S(I)-RC*ALOG(T(I)))*Q/SR
      CVB(I) = (C(I)*Q-R)/SR
   8  TB(I) = T(I)/TR
      RETURN
      END
C
      SUBROUTINE IDEALF(TT,X)
C HERE THE AO FUNCTION FOR THE MIXTURE IS COMPUTED FROM THE FZ4 AND
C  FZ5 VALUES OBTAINED EARLIER.
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /IDEAL/ AZ,SZ,CVZ
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      COMMON /XDERIV/ AXX,PXX,FXX,HXX,QXX,VXX,TXX,AZXX
      T = TT*FX
      CALL FZ4(T,AZ4,SZ4,CVZ4)
      CALL FZ5(T,AZ5,SZ5,CVZ5)
      TERM = 0.
      IF(X.GT.0. .AND. X .LT. 1.) TERM = X*DLOG(X)+(1.-X)*DLOG(1.-X)
      IF(X.GT.0. .AND. X .LT. 1.) TERMX = 2.+DLOG(X)-DLOG(1.-X)
      AZ = (X*AZ5 + (1.-X)*AZ4) + RSS*T*TERM
      SZ = (X*SZ5 + (1.-X)*SZ4) - RSS*TERM
      CVZ = (X*CVZ5 + (1.-X)*CVZ4)
      AZXX = AZ5-AZ4 + RSS*T*TERMX
      RETURN
      END
```

```
C
      SUBROUTINE INTRPL(X,Y,K,XO,YO)
C LAGRANGIAN INTERPOLATION ROUTINE FOR USE WITH THE ISOPENTANE IDEAL
C  GAS PROPERTY TABLES.
      DIMENSION X(100),Y(100),XLAG(30)
      YO=0.
      DO 1220 I=1,K
      XLAG(I)=1.0
      DO 1215 J=1,K
      IF(J-I) 1210,1215,1210
 1210 XLAG(I)=XLAG(I)*(XO-X(J))/(X(I)-X(J))
 1215 CONTINUE
 1220 YO=YO+(XLAG(I)*Y(I))
      RETURN
      END
C
      SUBROUTINE CONFML(D,T)
C COMPUTE THE CONFIGURATIONAL PORTION OF THE REFERENCE FUNCTION AND
C  ITS DERIVATIVES.
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /DERIVS/ DADT,CVR,DPDTR,D2P
      COMMON /QQQQ/ Q,ARES,QAB,Q10,Q20,Q11,QUB,QSB,CVB,DPDTB,DPDB
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      COMMON /CONF/ PCF,ZCF,ACF,SCF,CVCF,DPDD,DPDT
      HL = -DLOG(HX)
      CALL QQ(T,D)
      PCF = PBASE(D,T)+Q
      ZCF = PCF/D/T/RSS
      ACF = (QAB+ARES)/T/RSS + HL
      SCF = (QSB-DADT)/RSS - HL
      CVCF = (CVB+CVR)/RSS
      DPDD = (DPDB+Q11)/T/RSS + ZCF
      DPDT = (DPDTB+DPDTR)/D/RSS - ZCF
      RETURN
      END
C
      SUBROUTINE FACTOR(X,D,T)
C THE SHAPE FACTORS AND THE FX, HX AND QX ARE COMPUTED HERE.
      IMPLICIT REAL*8(A-H,O-Z)
      CALL MIXRUL(X)
      CALL SHAPE(X,D,T)
      RETURN
      END
C
      SUBROUTINE SHAPE(X,D,T)
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      COMMON /CRITC / PC4,PC5,DC4,DC5,TC4,TC5,PI4,PI5,DI4,DI5,TI4,TI5
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      COMMON /XDERIV/ AXX,PXX,FXX,HXX,QXX,VXX,TXX,AZXX
      WMX = (1.-X)*WM4 + X*WM5
      CALL THPHI(D,T)
      FX = TCX/TC4 *(1.+X*(TH-1.))
      HX = VCX*DC4 *(1.+X*(PH-1.))
      QX = FX/HX
      FXX = TXX/TC4 *(1.+X*(TH-1.))
      HXX = VXX*DC4 *(1.+X*(PH-1.))
      QXX = FXX/HX - FX*HXX/HX/HX
      RETURN
      END
```

```
      SUBROUTINE MIXRUL(X)
      IMPLICIT REAL*8 (A-Z)
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      COMMON /CRITC / PC4,PC5,DC4,DC5,TC4,TC5,PI4,PI5,DI4,DI5,TI4,TI5
      COMMON /XDERIV/ AXX,PXX,FXX,HXX,QXX,VXX,TXX,AZXX
      CALL COMRUL
      VCX = (1.-X)**2/DC4 + 2.*X*(1.-X)*V45 + X*X/DC5
      TCX = (1.-X)**2*TC4 + 2.*X*(1.-X)*T45 + X*X*TC5
      VXX=2.*((X-1.)/DC4+(1.-2.*X)*V45+X/DC5)
      TXX=2.*((X-1.)*TC4+(1.-2.*X)*T45+X*TC5)
      RETURN
      END
C
      SUBROUTINE COMRUL
      IMPLICIT REAL*8 (A-Z)
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      COMMON /CRITC / PC4,PC5,DC4,DC5,TC4,TC5,PI4,PI5,DI4,DI5,TI4,TI5
      CALL CLPARM
      T45 = FFT*(TC4*TC5)**(.5)
      V45 = FFV*(.5*DC4**(-.3333) + .5*DC5**(-.3333))**3
      RETURN
      END
C
      SUBROUTINE CLPARM
      IMPLICIT REAL*8 (A-H,O-Z)
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      FFT = 1.002
      FFV = .995
      RETURN
      END
C
      SUBROUTINE THPHI(D,T)
      IMPLICIT REAL*8 (A-H,O-Z)
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      TT=T-1.
      DD=D-1.
      TH = 1. + .0065*DD - .015*TT
      PH = 1. -.065*TT - .021*DD
      RETURN
      END
C
      SUBROUTINE THERM(D,T,X)
C ALL FUNCTIONS FOR THE MIXTURE ASSEMBLED HERE.
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      COMMON /UNITS/ IX,IT,ID,IP,IH,NT,ND,NP,NH,FT,FD,FP,FH,IFLAG
      COMMON /IDEAL / AZ,SZ,CVZ
      COMMON /CONF  / PCF,ZCF,ACF,SCF,CVCF,DPDDCF,DPDTCF
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      COMMON /PROPS / P,A,G,H,U,S,CV,CP,DPDD,DPDT,W
      COMMON /XDERIV/ AXX,PXX,FXX,HXX,QXX,VXX,TXX,AZXX
      CHARACTER*6 ND,NH
      CHARACTER*1 IFLAG,IFB,IFA
      DATA IFB,IFA/1H ,1H*/
      IFLAG=IFB
      IF(D.GT..7D0 .AND. D.LT.1.3D0 .AND. T.GT..99D0 .AND. T.LT.1.02D0)
     1  IFLAG=IFA
      CALL IDEALF(T,X)
      CALL CONFML(D,T)
      P = PCF * QX
      A = AZ + RSS*T*FX*ACF
      G = A + P/D *HX
      S = SZ + RSS*SCF
      U = A + T*S*FX
      H = G + T*S*FX
```

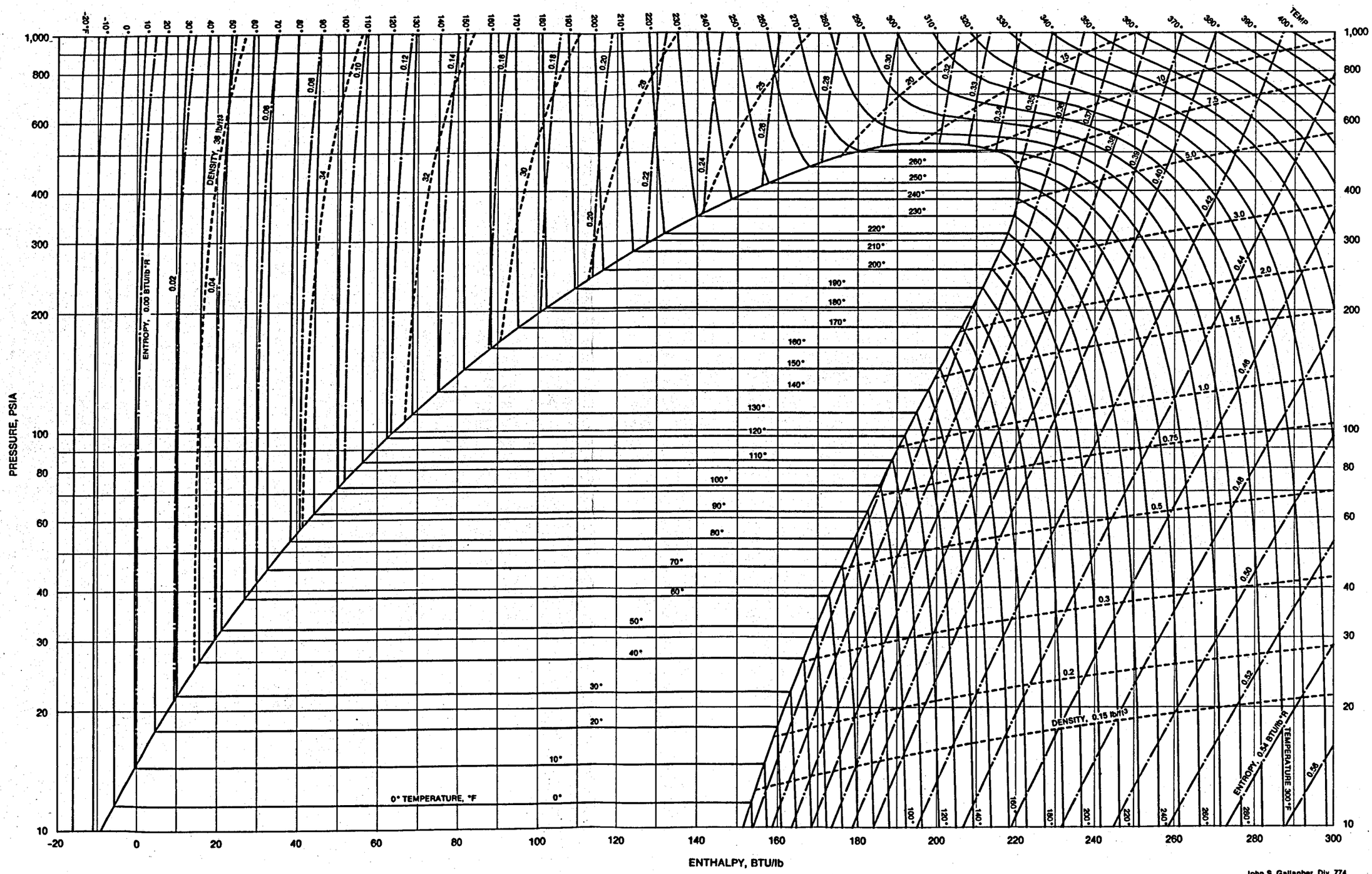
```
      CV = CVZ + RSS*CVCF
      DPDT = (DPDTCF+ZCF)*D*RSS/HX
      DPDD = (DPDDCF+ZCF)*T*RSS*FX
      CP = CV + FX*HX*HX*T*DPDT**2/DPDD/D/D
C     PXX = PCF*QXX + DPDD*D*QX*HXX/HX - DPDT*T*QX*FXX/FX
      S1=PCF*QXX
      S2=D*DPDD*QX*HXX/HX
      S3=T*DPDT*QX*FXX/FX
      PXX = S1+S2-S3
      RETURN
      END
C
      SUBROUTINE MU(XMU1,XMU2,D2ADX2,D,T,X)
C CALCULATION OF THE CHEMICAL POTENTIALS
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      COMMON /UNITS/ IX,IT,ID,IP,IH,NT,ND,NP,NH,FT,FD,FP,FH
      COMMON /IDEAL / AZ,SZ,CVZ
      COMMON /CONF  / PCF,ZCF,ACF,SCF,CVCF,DPDDCF,DPDTCF
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      COMMON /PROPS / P,A,G,H,U,S,CV,CP,DPDD,DPDT,W
      COMMON /INX/ DELX
      CALL FACTOR(X,D,T)
      HXO=HX
      FXO=FX
      QXO=QX
      CALL BB(T)
      CALL XTHERM(D,T,X)
      AO=A
      GO=G
      PO = P
      DELX=5.D-4
      IF(X.GT..9995D0) DELX=1.D0-X
      IF(X.LT.5.D-4)  DELX=X
      X1=X+DELX
      IF(X.EQ.0.) X1=1.D-6
      CALL FACTOR(X1,D,T)
      D1=D*HX/HXO
      T1=T*FXO/FX
      CALL BB(T1)
      CALL XTHERM(D1,T1,X1)
      P1=P
      A1 = A
      X2=X-DELX
      IF(X.EQ.1.) X2=.999999D0
      CALL FACTOR(X2,D,T)
      D2=D*HX/HXO
      T2=T*FXO/FX
      CALL BB(T2)
      CALL XTHERM(D2,T2,X2)
      P2=P
      A2 = A
      IF(DELX.EQ.0.D0) DELX=5.D-7
      DADX = (A1-A2)/(X1-X2)
      D2ADX2 = ((A1-AO)/(X1-X) - (AO-A2)/(X-X2))*2./(X1-X2)
      XMU1 = GO - X*DADX
      XMU2 = GO + (1.-X)*DADX
      RETURN
      END
```

```
      FUNCTION XBASE(D,T)
C THE SUBROUTINES WITH NAMES BEGINNING WITH X ARE THE SAME AS THE
C  PREVIOUS ONES OF THE SAME NAME WITHOUT THE X, BUT FOR INCREASED
C  SPEED OF CALCULATION ONLY P, A, G AND DP/DD ARE CALCULATED.
      IMPLICIT REAL*8  (A-H,O-Z)
      COMMON /QQQQ/ Q0,Q1,QAB,Q3,Q4,Q5,QUB,QSB,QCVB,DPDTB,DPDDB
      COMMON/ELLCON/ B1,B2,B1T,B2T,B1TT,B2TT
      COMMON /RCONST/ TRR,PRR,DRR,ARR,SRR,WRR,R,RSS,WM4,WM5,WMX
      Y=B1*D
      X=1.-Y
      DPDDB = RSS*T*(9.*Y*Y/X**4 + Y/X/X - 1./X)
      QAB = D*T*B2 + RSS*T*(DLOG(D/X)+1.5/X/X-4.*D*B1)
      XBASE = D*D*(T*B2 + RSS*T/D*(1./X+3.*Y/X**3-4.*Y))
      RETURN
      END
CC
      SUBROUTINE XQQ(T,D)
      IMPLICIT REAL*8  (A-H,O-Z)
      COMMON /QQQQ/ Q,ARES,Q02,Q10,Q20,Q11,Q7,QA,Q9,Q010,DPDDB
      COMMON/DERIVS/ DADT,D2A,DPDT,D2P
      COMMON /NCONST/ A(25),AA,II(25),JJ(25),N
      COMMON /RCONST/ TRR,PRR,DRR,ARR,SRR,WRR,R,RSS,WM4,WM5,WMX
      Q=0.D0
      ARES=0.D0
      Q11=0.D0
      DPDT=0.
      E=DEXP(-AA*D)
      Q10=D*D*E
      Q20=1.D0-E
      XX=DABS(AA*D)
      IF(XX.LT.1.D-5) Q20=AA*D
      DO 10 I=1,N
      K=II(I)
      L=JJ(I)
      ZZ=K+1
      FCT=AA*ZZ*Q10*Q20**K*T**(1-L)
      DFCT=AA*AA*Q10*T**(1-L)*ZZ*Q20**(K-1)*(K-ZZ*Q20)
      B=A(I)*FCT
      Q11 = Q11 + A(I)*DFCT
      Q = Q + B
      Y=Q20/AA/Q10/ZZ
      ARES = ARES + B*Y
   10 CONTINUE
      RETURN
      END
CC
C
      SUBROUTINE XCONF(D,T)
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /DERIVS/ DADT,CVR,DPDTR,D2P
      COMMON /QQQQ/ Q,ARES,QAB,Q10,Q20,Q11,QUB,QSB,CVB,DPDTB,DPDB
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      COMMON /CONF/ PCF,ZCF,ACF,SCF,CVCF,DPDD,DPDT
      HL = -DLOG(HX)
      CALL XQQ(T,D)
      PCF = XBASE(D,T)+Q
      ZCF = PCF/D/T/RSS
      ACF = (QAB+ARES)/T/RSS + HL
      DPDD = (DPDB+Q11)/T/RSS + ZCF
      DPDT = (DPDTB+DPDTR)/D/RSS - ZCF
      RETURN
      END
C
```

```
      SUBROUTINE XTHERM(D,T,X)
      IMPLICIT REAL*8(A-H,O-Z)
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      COMMON /UNITS/ IX,IT,ID,IP,IH,NT,ND,NP,NH,FT,FD,FP,FH,IFLAG
      COMMON /IDEAL / AZ,SZ,CVZ
      COMMON /CONF  / PCF,ZCF,ACF,SCF,CVCF,DPDDCF,DPDTCF
      COMMON /RCONST/ TR,PR,DR,AR,SR,WR,R,RSS,WM4,WM5,WMX
      COMMON /PROPS / P,A,G,H,U,S,CV,CP,DPDD,DPDT,W
      CHARACTER*6 ND,NH
      CHARACTER*1 IFLAG,IFB,IFA
      DATA IFB,IFA/1H ,1H*/
      IFLAG=IFB
      IF(D.GT..7D0 .AND. D.LT.1.3D0 .AND. T.GT..99D0 .AND. T.LT.1.02D0)
     1  IFLAG=IFA
      CALL IDEALF(T,X)
      CALL XCONF(D,T)
      P = PCF*QX
      A = AZ + RSS*T*FX*ACF
      G = A + P/D *HX
      DPDD = (DPDDCF+ZCF)*T*RSS*FX
      DPDT = (DPDTCF+ZCF)*D*RSS/HX
      RETURN
      END
C
      SUBROUTINE GUESS(T,P,X,Y)
C AN INITIAL GUESS FOR THE XL AND XV IS CALCULATED HERE AS THE STARTING
C  POINT IN SOLVING THE EQUATIONS FOR COEXISTING PHASES.
      IMPLICIT REAL*8 (A-H,O-Z)
      COMMON /CRITC / PC4,PC5,DC4,DC5,TC4,TC5,PI4,PI5,DI4,DI5,TI4,TI5
      COMMON /MIXFAC/ FX,HX,QX,TH,PH,FFT,FFV,V45,T45,VCX,TCX
      P4S=PS(T)
      TX=T*TI4/TI5
      P5S=PS(TX)*PI5/PI4
      IF(P4S.EQ.0.D0) GO TO 10
      X=(P-P4S)/(P5S-P4S)
      Y=1.-(1.-X)*P4S/P
      RETURN
   10 IF(P5S.EQ.0.D0) GO TO 20
      XS=(T-TC4)/(TC5-TC4)
      CALL FACTOR(XS,1.D0,1.D0)
      PXS = QX
      X = XS + (1.-XS)*(P-PXS)/(P5S-PXS)
      Y = 1.-(1.-X)*(1.-XS)*PXS/P
      IF(X.LT..001) X=.001
      IF(X.GT..999) X=.999
      IF(Y.GT.X) Y=.9*X
      IF (Y.LT..001) Y=.001
      RETURN
   20 X=-1.
      Y=-1.
      RETURN
      END
C
      FUNCTION PS(T)
C THIS IS AN EQUATION APPROXIMATING THE ISOBUTANE VAPOR PRESSURE CURVE.
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      PS=0.
      IF(T.GE.1.) RETURN
  100 Y=1.-T
      A1=-6.83796
      A2=1.25220
      A5=-2.3406
      XN2=1.5
      X=(A1*Y+A2*Y**XN2+A5*Y**3)/T
      PS=DEXP(X)
      END
```

```
      SUBROUTINE DFIND(DOUT,P,D,T,DPD)
C THIS SUBROUTINE COMPUTES ITERATIVELY THE DENSITY AS A FUNCTION OF
C  TEMPERATURE AND PRESSURE. AN INITIAL GUESS FOR THE DENSITY IS REQUIRED.
      IMPLICIT REAL*8 (A-H,O-Z)
      COMMON /QQQQ/ Q0,Q1,Q2,Q10,Q20,Q11,Q7,Q8,Q9,Q010,DPDDB
      TOL=1.0D-06
      DD=D
      L=0
    9 L=L+1
      IF(DD.LE.0.) DD=1.D-6
      IF(DD.GT.3.6) DD=3.6
      CALL BB(T)
      CALL XQQ(T,DD)
      PP=XBASE(DD,T)+Q0
      DPD = 2.*PP/DD + DPDDB + Q11
      DPDX=DPD
   10  X1=D
       XX=DD
      IF(DPDX.GT.1.D1) TOL=1.0D-5
      IF(DPDX.GT.1.D2) TOL=1.0D-4
      IF(DPDX.GT.1.D3) TOL=1.0D-3
      IF(DABS(1.-PP/P).LT.TOL) GO TO 20
      X2=(P-PP)/DPDX
      X=X2
   15 DD=DD+X
      IF(DD.LE.0.) DD=1.D-8
      IF(L.LE.40) GO TO 9
      DD=DD-X
      X2=X2/DD
      WRITE(6,1000)P,PP,X1,XX,T,X2,DPD
   20 CONTINUE
      DOUT=DD
 1000 FORMAT(' 40 ITERATIONS  IN DFIND PIN PCALC DIN DCALC T FRAC
     1DPD',4D13.6/3D13.6)
      RETURN
      END
```

THERMODYNAMIC PROPERTIES OF ISOBUTANE



John S. Gallagher, Div. 774
National Bureau of Standards
December 1982

THERMODYNAMIC PROPERTIES OF 90% ISOBUTANE — 10% ISOPENTANE MIXTURE