NBSIR 84-2811

Definition of Recommended Values of Certain Thermodynamic Properties for the Ketones

Thermodynamics Research Laboratory
Box 1144
Washington University
St. Louis, Missouri 63130

December 1983

Final Report to Office of Standard Reference Data, NBS

Issued January 1984

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

NBSIR 84-2811

DEFINITION OF RECOMMENDED VALUES OF CERTAIN THERMODYNAMIC PROPERTIES FOR THE KETONES

Buford D. Smith and Ol Muthu

Thermodynamics Research Laboratory
Box 1144
Washington University
St. Louis, Missouri 63130

December 1983

Final Report to the Office of Standard Reference Data, National Bureau of Standards, on Grant NB 80 NADA 1047. This work was supported by the National Science Foundation under a joint program on Critical Compilation of Physical and Chemical Data coordinated by the Office of Standard Reference Data.

Issued January 1984

U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, *Secretary*
NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director*

Contents

Contents--Continued Page

List of Tables

Definition of Recommended Values of Certain Thermodynamic Properties for the Ketones

Buford D. Smith

Ol Muthu

Thermodynamics Research Laboratory, Box 1144,

Washington University, St. Louis, Missouri 63130

Experimental data for the vapor pressure, liquid density, second virial coefficient, and certain compound constants for the ketones were retrieved in a comprehensive sweep of the literature. The vapor pressure and liquid density data were subjected to an intensive selection-deletion process to identify the best available experimental data points for each compound. Those data were carefully correlated with reliable equations in order to put the selected data into a form convenient for use in computer data banks. The second virial coefficient data were not subjected to such an intensive evaluation process; that predictive correlation equation which provided the best overall representation of the literature data sets for each compound was chosen for use in the data bank. Values of the compound constants were selected subject to the requirement that those constants related to the vapor pressure and liquid density be consistent with the selected correlations for those properties. Whenever possible, the parameters for the best available equations of state are provided. The correlation equations can be used to provide tabulations of vapor pressure, saturated liquid density, second virial coefficients, heat of vaporization, and saturated vapor volume to the extent permitted by the available good experimental data.

Key words: Critical properties; data evaluation; equation of state; ketones; liquid density; literature retrieval; melting point; normal boiling point; property correlation; second virial coefficient; selected data; vapor pressure.

1. Scope of Project

1.1. Relevant Compounds

The compounds relevant to this report have the following three characteristics: (a) they contain only elements from the following list,

carbon
hydrogen
oxygen
nitrogen
sulfur
halogens (F, Cℓ, Br, I)
"rare" gases (He, Ne, Ar, Kr, Xe, Rn)
silicon,

(b) they contain one or more carbonyl (C=O) groups, and (c) they contain only those other characteristic groups which fall below the carbonyl group in the IUPAC priority list for citation as the principal group. Those classes of compounds whose characteristic groups fall below the ketones are the alcohols, phenols, thiols, hydroperoxides, amines, imines, ethers, sulfides and peroxides. Those characteristic groups excluded by the IUPAC priority list are the carboxylic acid, sulfonic acid, ester, acid halide, amide, amidine, nitrile and aldehyde groups.

If a compound which satisfies the above criteria does not appear in this report, its absence is due to the fact that no useable data were found for that compound in the literature.

1.2. Properties Covered

An attempt has been made to report values of the following properties for all those relevant compounds for which useable data appear in the literature:

1. Compound constants (melting point, normal boiling point, critical properties and acentric factor).
2. Vapor pressure.
3. Saturated liquid density.
4. Second virial coefficient.

In addition, equation of state constants are tabulated whenever they are available.

Two calculated properties follow easily from the above experimental properties--the saturated vapor molar volume and the heat of vaporization--and those properties are included in the data tables whenever possible. When the vapor pressure is known and an adequate equation of state is available, the saturated vapor molar volume can be calculated. The heat of vaporization can be calculated from the Clapeyron equation when vapor pressure, saturated vapor molar volume and the saturated liquid molar volume are all available.

Because of their usefulness in various correlations, particularly those for the second virial coefficient, values of the dipole moment and the radius of gyration also have been included when readily available. No attempt was made to retrieve and evaluate literature values for the dipole moment, nor to calculate values for the radius of gyration. The dipole moment values listed were taken from McClelland [5266][1] and the radius of gyration values from Thompson [1706].

---

[1]Figures in brackets indicate literature references listed in the References section at the end of this report.

1.3. Literature Covered

The ketone project was part of a long-range program dealing with all organic and some inorganic compounds. Over 25,000 relevant literature documents have been retrieved as part of the overall program, and it is believed that number is within 1000 to 2000 of the total number of relevant documents in existence. Retrieval of old documents is continuing along with the retrieval of newly-published relevant documents.

Literature searches for specific compounds are not feasible when retrieving on such a large scale. As an alternative, four techniques have been used in an attempt to sweep all the relevant documents from the published literature:

1. Selected journals (see table 1) have been "clean-swept"; i.e., a trained searcher leafed through the journal from the first to the last volume looking for relevant documents. The titles and abstracts were not assumed to be sufficient evidence of relevancy or non-relevancy.
2. About 100 compilations, bibliographies, review articles, etc., dealing with the compounds and properties of interest were searched for literature citations of interest.
3. The relevant sections in all the Chemical Abstract volumes for Volume 1 (1907) through Volume 64 (1965) were swept. After 1965, the yearly volumes of the Bulletin of Chemical Thermodynamics were substituted for Chemical Abstracts.
4. The literature citations in each document from which data are transcribed were checked for relevancy and the documents retrieved if not already in hand.

Table 1. Journals which have been clean-swept

Acta Chemica Scandinavica
AIChE Journal
Australian Journal of Chemistry
Berichte der Bunsengesellschaft fuer Physikalische Chemie
Canadian Journal of Chemistry
Chemical Engineering Progress
Chemical Engineering Progress, Symposium Series
Chemical Engineering Science
Chemical Reviews
Chemical Society Reviews
Collection Czechoslovak Chemical Communications
Discussions of the Faraday Society
Fluid Phase Equilibria
Industrial and Engineering Chemistry
Industrial and Engineering Chemistry, Fundamentals
Industrial and Engineering Chemistry, Process Design and Development
Journal of American Chemical Society
Journal of Applied Chemistry (USSR)
Journal of Chemical and Engineering Data
Journal of Chemical Physics
Journal Chemical Society, Faraday Transactions I.
Journal Chemical Society, Faraday Transactions II.
Journal of Chemical Society (London)
Journal of Chemical Thermodynamics
Journal de Chimie Physique
Journal fuer Praktische Chemie
Journal Physical and Chemical Reference Data
Journal of Physical Chemistry
Thermochimica Acta
Pure and Applied Chemistry
Russian Journal of Physical Chemistry
Transactions of the American Institute of Chemical Engineers
Transactions of Faraday Society
Zeitschrift fuer Physikalische Chemie (Frankfurt)
Zeitschrift fuer Physikalische Chemie (Leipzig)

Newly-published relevant documents are identified by scanning the weekly issues of Current Contents/Physical Sciences, and by periodic updates of the first three items listed above.

One major omission in the coverage of the literature should be noted. No attempt was made to cover all the organic synthesis literature where melting point, boiling point, and 20° or 25 °C density data are often reported as a means of identification of a newly synthesized compound. There are two reasons for that omission. First, that body of literature is very large, and its coverage would have increased the retrieval load by at least another 10,000 documents. Second, the compound constant values reported are usually suspect because of uncertain purities, poor measurement techniques, etc. Hence, a very large expenditure of effort almost invariably yields very little in the way of useful results. Consequently, the decision was made to concentrate on those documents where the measurement of thermodynamic data was a primary objective of the authors.

It is believed that the above approach to retrieval makes available over 95% of all relevant documents and over 98% of the useable data. The overall retrieval percentage for the good data probably approaches 100% but it is always possible to miss an important document for a specific compound when dealing with hundreds of compounds and thousands of documents. The authors will appreciate being informed of any such omissions.

Of the 25,000+ documents which were retrieved, 2956 contained some sort of information on ketones. Of those 2956, only 784 reported data on properties relevant to this project.

2. Project Output

The objective of the long-range program, of which this ketone project has been a part, is the development of thermodynamic data banks which can be stored in the user's computer system. A strong effort is made to identify, retrieve and screen all the useable literature data for the properties covered. The selected literature data are then stored in the data bank, with the temperature-dependent properties being stored in the form of correlation constants. The data banks, plus their associated software, make all the useful literature data available to the user through his computer terminal in an immediately useful form. Or, the user may have his computer programs access the data banks directly for the needed thermodynamic data.

The emphasis upon computer accessibility has had a major impact upon the reporting format for this project. The selected values for the temperature dependent properties--vapor pressure, liquid density and second virial equation--are reported in the form of constants for correlation equations. For the user who needs the selected data values in readable form, tables can be generated over the temperature ranges corresponding to the experimental data limits on the correlating equations. Those tables also include two calculated properties--the saturated vapor molar volume and the heat of vaporization--whenever the data necessary for their calculation are available.

When numerical data values are processed en masse through a computer, it becomes difficult to reflect the reliability of a recommended value by the number of decimal digits carried, and the attempt to do so was finally abandoned. The number of digits printed was set to accommodate the best data --three decimal digits for temperature, six decimal digits for density, etc.-- and all property values printed with the same number of digits regardless of reliability. Hence, the reader must become accustomed to the sight of a normal boiling point printed with three decimal places when the uncertainty may be as high as 1 or 2 K in extreme cases. Or, the sight of density values printed with six decimal places when only three would be sufficient to carry all the information provided by the experimental measurements. The printing of the extra digits does have some justification beyond that of expediency when the units must be changed. Two unit conversion steps with truncation back to the number of justified digits after each conversion can sometimes create a result which, if it is then converted back to the original units, is quite different from the original literature value. That situation sometimes arises when authors have reported their results twice in different journals using different units. Then when the two sets of values are both converted to SI units and compared, the differences are uncomfortably large. The only way to minimize the effect of such numerical static is to minimize the effect of truncation by carrying extra digits.

The fact that the ketone project was a part of the larger data evaluation project influenced the reporting format in an additional way. As the literature documents are retrieved, their citations are added to the Laboratory's Master Reference List (MRL). The MRL number serves as a document's identification number in the data processing, and that method of identification has been retained in this report. The reader will note that the number sequence in the ketone bibliography in the References section is not continuous, but otherwise the MRL numbers which appear in this report are just like ordinary reference numbers.

3. Units

The conversion of the literature data to the units used for processing and reporting is accomplished by the CON programs (CONCON for compound constants, VAPCON for vapor pressure, DENCON for liquid density and BCON for the second virial coefficient). The conversion units used by the CON programs are given in the identity strings below. The first unit in each string is the unit used for processing.

$$1.0\ K = °C + 273.15 = 273.15 + (°F-32)/1.8 = °R/1.8$$

$$101.325\ kPa = 1.0\ atm = 760\ mm\ Hg = 14.69595\ psi$$
$$= 29.92126\ in.\ Hg. = 1.033227\ kg/cm^2 = 1.01325\ bar$$

$$1.0\ g/cm^3 = 1.000028\ g/ml(old) = 62.42795\ lb/ft^3 = 8.345403\ lb/gal$$

The water density data of Kell [3222] are used to convert specific gravity data to density (g/cm^3) values. The table of Douglas [3163] is used to convert reported temperatures to the IPTS-68 scale as necessary. The gas constant value used is 8.31441 kPa cm^3/mol K.

It is assumed that the old milliliter is related to the cubic centimeter by

$$0.999972 \text{ ml} = 1.0 \text{ cm}^3$$

However, it is usually not certain whether the data are reported in terms of the old milliliter or of the new milliliter which is equivalent to the cubic centimeter. Hence it is necessary to operate under arbitrary rules which hopefully maximize the probability of being correct in any given instance. If the units are not specifically defined in a document, specific gravity values are assumed to be in g/ml(old) and the 1.000028 factor is applied by the CON program. If the data are described as "density" data, the values are assumed to be g/cm^3. However, when checking the transcriber's work, the evaluator can change the unit code on specific gravity data from g/ml(old) to g/cm^3 if he thinks it probable that the authors used the new milliliter. Unfortunately, it is usually impossible to determine whether or not the 1.000028 correction factor should be applied.

The temperature scale used is also a matter of conjecture in most cases. Very few documents identify the temperature scale used. In such cases, the IPTS-68 scale is assumed for papers published in 1972 and later; the three-year lag is based on the assumptions that the data appeared in print one or two years after its measurement, and that the laboratory reporting the data probably would not have converted to the new scale until a year or two after the 1968 scale was announced. For papers published in 1971 and earlier years, all the data are assumed to be on the 1948 temperature scale; i.e., the only two temperature scales recognized by the CON programs are the 1948 and 1968 scales. Again, the evaluator can change the temperature scale code entered by the transcriber if he thinks the blanket rule might not apply.

4. Evaluation Procedures

4.1. Compound Constants

Of the compound constants subjected to a selection process, only the triple point and melting point are independent of the temperature-dependent correlations developed for the vapor pressure and the liquid density. Whenever a temperature-dependent correlation can be established for the vapor pressure, the recommended normal boiling point, critical temperature, critical pressure and acentric factor values reported come from that correlation. Similarly, the critical volume value comes from the liquid density correlation, as would the 20 and 25 °C densities if needed by the user. The critical compressibility factor Z_c is calculated from the T_c and P_c values from the vapor pressure correlation and the V_c value from the liquid density correlation using an R value of 8.31441 kPa cm^3/mol K.

Before the vapor pressure and liquid density data are processed, tentative values of the compound constants (except for the dipole moment and the radius of gyration) are selected from the available literature values using program CONCON. Data from the major relevant compilations [1051, 1146, 3270, 3375, 41765] are transcribed directly onto the CONCON input forms. The 20 and 25 °C density values and the critical density values from all the 2956 ketone documents are transcribed first as density data input (program DENCON) and then copied onto the CONCON input forms. Similarly, the normal boiling point and critical temperature and pressure values are first transcribed as vapor pressure data (program VAPCON) and then copied for CONCON. Of all the compound constants, only the triple and melting points are transcribed in a separate pass through the 2956 documents. Actually, the person looking for triple and melting point values also transcribes critical property values; this dual coverage for the critical properties is made to decrease the probability of missing any critical point data.

Once the CONCON input file is complete, the program is used to convert all the input values to the processing units and list the literature values for each property (20° liquid density, 25° liquid density, triple point, melting point, normal boiling point, critical temperature, critical pressure, critical density and critical volume) in the order of ascending MRL numbers. All the temperatures are corrected to the IPTS-68 temperature scale except for those related to the 20° and 25 °C density values; those are allowed to remain as 293.15 and 298.15 K.

In the column of numbers for each property for each compound, the evaluator marks a tentative selected value. In the selection of those tentative values, the evaluator relies heavily upon the values reported by the major compilations of selected values, namely those of Ambrose [41765], the Thermodynamics Research Center at Texas A&M [3270], Kudchadker et al. [1051], and Kobe et al. [3375]. A value other than the one reported by the most recent of the above four compilations will be selected only if justified by the publication of high-quality values since the publication date of the compilation.

There is seldom any reason to change the initially selected values for the triple point and melting point, and the values marked on the CONCON printout are usually the final values.

The tentative values selected for the 20° and 25 °C liquid densities and the normal boiling point are used as guide-lines in fixing the temperature correlations for the density and vapor pressure but, once those correlations are established, the selected values almost invariably have to be changed to conform to the correlations.

Whether or not the initially selected critical point values are changed depends upon the relative strengths of those initially selected critical point values and the high-temperature vapor pressure or liquid density data with which the selected critical values have to be matched. When the initially selected critical point values are believed to be firmer than the high-temperature data, the correlation is forced to pass through that selected critical point and any high-temperature data points which disagree too badly are discarded. If there is a set of high-temperature vapor pressure or liquid density data which is of high-quality, but which has no associated critical point values and does not line up with the initially selected critical values, it is sometimes necessary to adjust the critical values to conform with the other data. If the initially selected critical values are of reasonably good quality, the adjustment necessary to achieve conformity is usually within the experimental error associated with the reported values. In any case, the compound constant values reported for the vapor pressure and liquid density are always those calculated from the temperature correlations for those two properties.

The requirement that the density and vapor pressure compound constants conform to the temperature correlations may or may not make the final values better than those in earlier compilations. If high-quality data sets are available in regions of the compound constants, the correlation values will be firm and reliable. If the temperature-dependent points being fitted have little to recommend them other than their existence, the calculated compound constants can be less accurate than values obtained in other ways. For example, if one assembled all of the reported normal boiling point (or 20° and 25 °C density) values for a group of similar compounds and then forced the selected values for the individual compounds to agree with assumed correlations with respect to carbon number, branching, etc., it is highly probable that the values thus obtained for a given compound would not fall on the correlation curve for the available temperature-dependent points in the region. Which is more accurate depends upon the relative accuracies of the two conflicting correlations. That can only be decided by an analysis of each case, and even then the final decision may have to be arbitrary. In this report, the main objective is to provide the best available temperature correlation equations for use on a computer, and it is necessary to report compound constants which are compatible with those correlations. However, when it is essential for the user to have the best possible value of a compound constant, the firmness of the temperature-correlation should be examined (number and sources of competing data sets, number of points fitted, root-mean-square-deviation, etc.) and, if found doubtful, the user should consider values from other sources, particularly those in the TRL tables [3270].

4.2. Vapor Pressure

4.2.1. Unit Conversion Step

All of the vapor pressure data which can be found for the compound class being processed in the relevant documents (2956 for the ketones) are transcribed on input forms for program VAPCON (the unit conversion program for vapor pressure data), sorted by compound, and keyed into a computer disk file denoted as ORIGP. Program VAPCON is then run with ORIGP as the input file. The VAPCON output goes to the CONVP (converted) disk file. Besides correcting the temperatures to the IPTS-68 scale and converting the pressure units to kilopascals as necessary, VAPCON fits the equation

$$\ln P' = A - \frac{B}{T} \qquad (1)$$

to two selected data points ("anchor" points selected by the evaluator for each compound) and stores the residual (deviation from the equation) for each literature data point in the CONVP file. Those residuals are scanned to identify points with extraordinarily large residuals. If a large residual is due to a transcription or keying error, the ORIGP file is corrected; if not, the wild point is deleted from the ORIGP file. After the ORIGP file has been cleared of all erroneous and obviously inconsistent data points, program VAPCON is run again to provide a "clean" CONVP file for use as input to the plotting program GENPLT.

4.2.2. Plotting Step

Program GENPLT plots the literature data points for each compound in the form of the VAPCON residuals versus temperature. The ordinate scale for each compound plot is automatically determined by the minimum and maximum residual values for the compound--the objective is to spread the data points as much as possible on the eight-inch high plots. A different plotting symbol is used for each literature document providing data, and those symbols are related to the documents' MRL numbers in a tabulation at the end of each compound plot. Up to 128 different symbols are available, but in practice an effort is always made to screen the data for commonly-used compounds (such as acetone) in order to reduce the number of literature sources listed in the ORIGP file to a number less than 100 before running VAPCON.

The evaluator's objective at this point is to establish the "track" where he believes the vapor pressure-temperature curve for each compound should lie on the residual plots. The tentative selected normal boiling and critical point values are important guides. In addition, each document providing data for a compound is inspected to determine the probable quality of each set of data.

For heavily-measured compounds, the tracks of the final correlations on the residual plots will be covered by more of less solid bands of data points, particularly near the normal boiling points. In order to expand those bands and obtain a better resolution of the data points near the desired tracks, the evaluator deletes from the input CONVP file all the outlying points which obviously are not going to be included in the final correlations and then runs GENPLT again.

For those compounds with sparse data, the first GENPLT plot is all that is needed. For a compound with a fairly large number of data points, the removal of the outlying points may permit the second GENPLT plot to expand sufficiently to distinguish between all the data sets. For heavily-measured compounds like acetone, three or four successive plots may be necessary. In addition to removal of the outlying points, the evaluator may find it necessary to restrict the temperature range for the next plot to that for the most heavily populated region. This may be necessary because eq (1) is a straight line cutting across the bow of the data points on a ln P versus 1/T plot, and it usually provides residuals which plot in a downwardly concave curve with negative values at both ends and positive values in the middle. By restricting the maximum and minimum temperature and residual limits in the compound's data set in the CONVP file, only the points in the heavily populated region can be plotted and made to expand to fill the entire eight-inch plot.

The GENPLT plots are, of course, just a mechanical aid for the basic evaluation process--the considered deletion of some points while retaining others. Often, the decision to delete or retain a point is made easy by that point's position relative to the bulk of the equally reliable points on a properly expanded residual versus temperature plot. After the easy decisions have been made, the final definition of the correlation track must be based on the evaluator's appraisal of the relative qualities of the remaining competing data points. The source of the data can be a deciding factor; one expects data from sources such as the U. S. National Bureau of Standards, the National Physical Laboratory of England, etc. to be good. One cannot place much reliance on the stated experimental errors in most papers but, nevertheless, the evaluator can usually draw some fairly firm conclusions about the quality of the data from the manner in which the data are presented. Also, when dealing with a large number of compounds, the evaluator soon identifies those workers whose data usually fall in or close to the tracks defined for the compounds. He also soon recognizes those workers whose data usually fall away from the final track when highly reliable data sets are available for a compound.

In any case, based on the residual plots and his judgment as to the relative merits of the various data sets, the evaluator establishes the tracks on the residual plots of what he believes the best available property temperature correlations to be. Data points which deviate from those tracks are deleted. It is not uncommon for part of an extensive literature data set to be retained while the rest is deleted; the errors involved in a measurement can change with temperature and it is not unusual for the data points for an extensive data set to begin to bend away from those of other reliable data sets.

In some cases, the track will run between two data points or two sets of data points, neither one of which falls on the selected track. Rather than delete both and leave the correlation unsupported in that region, the evaluator may retain both if he believes the least squares fit will be closer to the truth with those points in the data base. In other words, the objective in the deletion process is not to achieve the lowest possible root-mean-squared-deviation value; the objective is to establish a string of data points which will give a correlation equation which represents the true property-temperature relation as well as can be inferred from the available experimental evidence.

While working with the residual plots, the tendency is to retain doubtful points in the temperature gaps between reliable sets of data. It is not possible to tell from the plots whether or not those points will provide useful support for the correlation equation or--because they fall a little off the track--may actually accentuate any tendency an equation might have to weave in a region where the data points are sparse.

4.2.3. Correlation Step

When the evaluator has gone as far as allowed by the residual plots in the definition of the final temperature correlations, the CONVP disk file (now reduced in size) is used as input to program CARDSORT which produces the SORTP file as output. CARDSORT merges the literature data sets for each compound and puts the data points in each of the resulting sets in the order of ascending temperature. The SORTP file then serves as the input for the vapor pressure fitting program PFIT.

The vapor pressure correlation equations contained in PFIT are shown in Table 2. The Riedel [838], Frost-Kalkwarf [2372], Riedel-Plank-Miller-2 [4529], and Wagner [40337] equations each contain only four constants while the Vapres-2 equation has five. Only the Wagner equation is a reduced equation.

Even a five-constant equation has a tendency to weave (irregular first and second temperature derivatives) when fitted to less than perfect data over a wide temperature range. Also, users of correlations often object to equations with a large number of constants. Hence, the vapor pressure equations used have been restricted to the relatively simple forms shown in Table 2.

On the other hand, even a five-constant equation will often not fit good smooth data within experimental error all the way from the melting point to the critical point. These conflicting considerations forced the use of the following four temperature ranges for the computer storage of vapor pressure data.

Range	Temperature range, K
1	T_m to T_c
2	T_m to $(T_b + 20)$
3	T_m to T_d
4	$(T_b - 20)$ to T_c

The T_m, T_b and T_c are the melting, normal boiling and critical temperatures, and T_d is defined by $T_d = 0.85\ T_c$. When T_c is not available, a T_d value is calculated from $T_d = 1.45\ T_b$.

Table 2. Vapor pressure correlation equations used

Riedel	$\ln_e P' = A + B \ln_e T + \frac{C}{T} + DT^6$
Frost-Kalkwarf	$\ln_e P' = A + B \ln_e T + \frac{C}{T} + \frac{DP'}{T^2}$
Riedel-Plank-Miller-2	$\ln_e P' = A + \frac{B}{T} + CT + DT^2$
Vapres-2	$\ln_e P' = A + \frac{B}{T} + CT + DT^2 + E \ln_e T$
Wagner	$\ln_e P'_r = A \frac{1-T_r}{T_r} + B \frac{(1-T_r)^{1.5}}{T_r} + C \frac{(1-T_r)^3}{T_r} + D \frac{(1-T_r)^6}{T_r}$

The order of priority for the use of the fits insofar as the accuracy of the fits is concerned is 2, 4, 3 and 1. The Range 1 fit is included for the user who is not particularly concerned about the best possible accuracy and does not want to worry about changing correlations in order to cover a wide temperature range.

In general, the equation form used to correlate the data for a given compound in a given temperature range is the one which best represents the selected data points. In the first PFIT run, the evaluator requests fits from all those equations which he believes might work well for each compound-range combination. From those results, the evaluator first selects the equation which works best for each compound-range combination, and then proceeds with any further data point deletions needed to achieve the final correlations.

The PFIT printout has several characteristics which aid in the selection of additional points to be deleted and in judging the performance of the equation used. First, the percent deviation of each point from the equation value is given. Second, the deviation of each point is displayed in terms of a positive or negative multiple of the root-mean-squared-deviation for the entire fit. Third, the normal boiling and critical point values calculated from the equation are compared to the tentative selected values. Fourth, the root-mean-squared-deviation for the fit is given and the maximum deviation point is identified. Fifth, the number of positive deviations and the number of negative deviations from the equation are given. Both of the first two items are necessary because of the very large change in the magnitude of the vapor pressure. At low temperatures, all the RMSD multiples are close to zero and the percent deviation values must be used. At high temperatures, the RMSD multiple display is more useful. That display, plus the numbers in the fifth item make it possible to tell at a glance whether the equation is splitting the data points or crossing back and forth across them.

After the first round of point deletions based on the first fits, PFIT is run the second time with a greatly reduced number of equation selections. Multiple equation selections may still be used for some compound-range combinations if the initial fits were competitive and it is felt that the new point deletions might affect the final choice. Based on the second PFIT run, the evaluator makes his final equation selections and may still decide to trim away a data point here and there. He may also decide to insert again some points deleted in the previous round. Usually all the correlations are fixed after the second PFIT run. PFIT is then run the third time to provide the final set of correlation constants and store them in a form which will facilitate the storage in the data bank.

In each of its runs, the "weave" check option in PFIT is used. That option requests the calculation and tabulation (as a function of temperature) of the first and second derivatives of P' and ln P' from each equation fit based on fewer than 30 data points. The derivative tabulations permit the evaluator to identify those fits which weave or take on odd slope values when the experimental data points are sparse and scattered. The five-constant Vapres-2 equation exhibits such behavior much more often than the four-constant equations.

On the final PFIT run, the boiling point and storage options in PFIT are also used. The storage option creates a disk file of the correlation constants. The boiling point option causes the calculation of the normal boiling point from each correlation equation. The evaluator then selects the value from either the range 2 or range 4 fits as the final selected value to replace the tentative value marked on the CONCON printout. The choice between the two ranges is based on (a) how closely each correlation fits the data points in the region of the boiling points, (b) which value agrees best with the tentative selected value, and (c) the relative firmness of the tentative selected value and the experimental data points being fitted. For well-studied compounds, the difference between the tentative and final selected values will usually be less than a few hundredths of a degree. For compounds where the normal boiling point is still a matter of conjecture, the difference can be as high as two or three degrees.

As explained in section 4.1, any necessary adjustments of the tentative T_c and P_c values will have been made before the final PFIT run, and there is no need to calculate new values consistent with the correlation equations. In short, the correlations are made to conform with the selected critical point values rather than vice versa.

When T_c and P_c values are available, the reduced Wagner equation is almost invariably used for those two ranges (1 and 4) which include the critical point; that is done to force an exact fit of the selected critical point values. Because it must go through the critical point, the Wagner equation is not as free to fit the other data points and, in relatively rare instances, the Riedel equation is used for ranges 1 and 4 if it reproduces the critical point closely enough and at the same time gives a better fit of the rest of the data than does the Wagner equation. The Riedel-Plank-Miller-2 equation is usually chosen for Ranges 2 and 3 when the data points are relatively sparse and scattered; that equation very seldom exhibits unreasonable temperature derivatives. If there are a lot of points in Ranges 2 and 3, the Riedel and Vapres-2 equations may be competitive.

The Vapres-2 equation is often useful when two good but separated data sets are available. For example, there may be a data set at very low temperature (close to the melting point), another set in the normal boiling point region, and a large gap between them with only miscellaneous scattered data points. It is usually difficult to tie two such data sets together without large deviations at both ends of the gap. Because of its fifth constant, the Vapres-2 equation is often more flexible in such situations.

The Frost-Kalkwarf equation is seldom used. In early work on a large number of hydrocarbons, it seldom showed any advantage over the other equations and its use gradually declined because of the inconvenience due to the presence of P' on both sides of the equation.

4.3. Liquid Density

4.3.1. Unit Conversion Step

The liquid density data processing procedures are similar to those described in section 4.2 for the vapor pressure data. All the literature data which can be found are keyed into the ORIGD disk file. Program DENCON corrects the temperatures to the IPTS-68 scale and the density or volume units to g cm^{-3} as necessary, and stores the converted literature data in the CONVD file. DENCON also calculates and stores a residual value for each data point based on a quadratic fit of three "anchor" density points selected from the input literature data by the evaluator. Those three points include one near the bottom of the temperature range, one near the top, and one at about three-fourths of the distance from the bottom to the top anchor point; those three points are chosen to allow the simple quadratic equation to approximate the density versus temperature curve near the critical region without generating inordinately large residuals. The special problems encountered in the unit conversions for density data have been discussed in section 3.

Erroneous and obviously inconsistent data points are identified and cleared from the ORIDG file as described in section 4.2.1 for the vapor pressure data. Then DENCON is run the second time to create a clean CONVD file for the plotting step.

4.3.2. Plotting Step

Program GENPLT is used to plot the density data in exactly the same way as described for vapor pressure. On one hand, the density data are easier to plot because the data values cover such a small numerical range. On the other hand, the quadratic is not as good for fitting density data as is the equation used for vapor pressure and hence the residuals sometimes are more erratic, particularly when the data extend to the critical point. Nevertheless, it is usually necessary to plot the density data fewer times than the vapor pressure data.

The 20° and 25 °C density points serve as guidelines in exactly the same way as the normal boiling point is used for vapor pressure to establish the correlation "track" on the residual plots, and the reasons for adjusting or not adjusting the tentative selected critical point values are the same as described in section 4.2.2. Also, the same approach is used in making the point deletion decisions.

4.3.3. Correlation Step

Once the evaluator has finished making deletions in the CONVD file based on the residual plots, program CARDSORT is used to merge the literature data sets for each compound and order those points with respect to temperature. The newly-ordered data are stored in the SORTD disk file.

The three density correlation equations used to fit the density data are shown in Table 3. Those three equations are contained in separate programs instead of being combined in one program as done for the vapor pressure. The low-temperature range Francis equation [4094] is in program FRANCIS1, and the high range Francis equation is in program FRANCIS2. The Rackett equation [4121, 4123] is applied by program RACKETT.

The temperature ranges used for the liquid density fits differ from those for the vapor pressure because of the difference in the shapes of the two property curves and the differences in the correlation equations. The low-range Francis equation can be fitted to the following ranges using program FRANCIS1.

Range	Temperature Range, K
1	T_m to (T_c - 10)
2	T_m to (T_b + 20)
3	T_m to (T_c - 30)
4	(T_b - 20) to (T_c - 10)

Francis [4094] recommended that his low-range equation be restricted to temperatures below (T_c - 30) and the range 3 fit observes that limit. However, it is sometimes possible to fit up to (T_c - 10) without serious loss of accuracy and the extended range is sometimes needed to overlap the fit obtained with his high range equation.

Table 3. Liquid density correlation equations used

Francis, $< (T_c-10)$	$d = A - BT - \frac{C}{E-T}$
Francis, $> (T_c-50)$	$d = [A(T_c-T)]^{1/B} + d_c$
Rackett	$\frac{V^L}{FW} = \frac{1}{d} = \frac{8.31441\ T_c}{(FW)P_c}\ Z_{RA}^{[1+(1-T_r)^{2/7}]}$

The high-range Francis equation (program FRANCIS2) is restricted to the (T_c - 50) to T_c range. Francis [4094] stated that the equation performed fairly well down to 50 to 100 degrees below the critical point. However, the region near the critical is difficult to fit without large percentage errors. That difficulty is caused by a combination of factors. First, the density curve near the critical is very steep and a small temperature error can cause a large deviation for a data point. Second, a short distance from the critical point the slope begins a rapid change to a small value. Third, the high-range Francis equation must pass through the critical point and quite often the selected d_c value will not be entirely consistent with the data points near the critical temperature. Hence, it is better to limit the high-range equation to a 50 K increment and stretch the low-range equation fits upward for the FRANCIS1 fits for ranges 1 and 4.

The Rackett equation is never competitive with the low-range Francis equation over the ranges 1, 2 and 3 used in program FRANCIS1. Hence, its use is restricted to the same (T_c - 50) to T_c range used by program FRANCIS2, but it is also seldom competitive with the high-range Francis equation.

The low-range Francis equation is a very reliable correlation equation and will always fit well within experimental accuracy any good set of data in range 2. The range 3 fit may sometimes fall a little out of the experimental error band because of the wide temperature range covered. The range 4 fit would be as good as the range 2 fit if the range were cut back to $T_c - 20$ or $T_c - 30$, but the small loss of accuracy sometimes caused by the extended temperature range is not an unreasonable price to pay. Also, the low-range Francis equation is remarkably free of slope problems when fitting sparse, scattered data points. In short, the low-range Francis equation is a very satisfactory correlation equation as long as one does not get too close to the critical points.

The low-range Francis equation fits are always used for the ranges 1, 2 and 3 as defined above for program FRANCIS1. When the data do not extend all the way to the critical, the FRANCIS1 range 4 fit is also used. If the data do extend to the critical, then a choice must be made between the FRANCIS1 range 4 fit and the $(T_c - 50)$ to T_c fit from FRANCIS2 (and possibly RACKETT).

The choice is easy if the FRANCIS2 (or RACKETT) fit is good. Then the FRANCIS2 or RACKETT fit over the $(T_c - 50)$ to T_c range is chosen for the range 4 correlation and overlapping fits are available from T_m to T_c. Sometimes the percentage errors in the FRANCIS2 fit are so large (for reasons described above) that the evaluator decides that coverage of the $(T_c - 10)$ to T_c range is not feasible. He then chooses the FRANCIS1 range 4 fit for the final range 4 correlation.

The FRANCIS1, FRANCIS2 and RACKETT printouts provide the evaluator with the same information as the PFIT printout to aid in the selection of points to be deleted and to aid in judging the quality of the equation fits. However, the "weave" option is not necessary for the density programs because the Francis equations are not as subject to slope problems as the vapor pressure equations. Also, the final density correlation equations are not asked to calculate values of the 20 and 25 °C densities. Only the option requesting disk storage of the correlation constants is used on the final fitting runs.

4.4. Second Virial Coefficient

The second virial coefficient data are not subjected to the extensive evaluation process applied to vapor pressure and liquid density data. The objective is just to select that predictive correlation equation which best represents the better literature data sets for each compound.

Six predictive equations are always tested: Kreglewski [6771], Pitzer and Curl [6288], O'Connell-Prausnitz [897], Tsonopoulos [11414], Nothnagel-Abrams-Prausnitz [9819], Hayden-O'Connell [8531]. No attempt is made to adjust the correlation constants; i.e., no least-squares data fitting is done.

The data processing for the second virial coefficient data starts like that for the vapor pressure and liquid density. All the literature data are first transcribed from the relevant literature documents onto input forms for program BCON. (Some data sets beyond those appearing in the Dymond and Smith [41648] compilation are usually found but they very seldom are of any significance. The Dymond and Smith book has been found to be an exhaustive compilation of existing good literature data.) The transcribed data are keyed into disk file ORIGB which serves as input to program BCON. BCON stores the converted B values in disk file CONVB.

Second virial data are reported in the literature for each of the following equations:

$$PV = A(1 + B/V + C/V^2 + \ldots) \tag{2a}$$

$$PV = A' + B'/V + C'/V^2 + \ldots \tag{2b}$$

$$PV = A^*(1 + B^*P + C^*P^2 + \ldots) \tag{2c}$$

$$PV = A'' + B''P + C''P^2 + \ldots \tag{2d}$$

The relations between the various second coefficients is

$$B = B'/RT = RTB^* = B'' \tag{3}$$

BCON converts all the literature second coefficient values as necessary to B values (eq (2a)) in terms of $cm^3\ mol^{-1}$. It also converts the data point temperatures to the IPTS-68 scale as necessary.

The BCON input file (ORIGP) must contain the correlation constants for each correlation to be tested. Those constants are taken from the literature documents for the individual correlations. All correlations for which constants can be found are always tested.

Using the CONVB disk file as input, program GENPLT produces a residual plot for each equation tested for each compound for which B values could be found in the literature. Data were found for the following ketones.

ID	compound
KE0300	acetone (2-propanone)
KE0400	2-butanone
KE0500	2-pentanone
KE0501	3-pentanone
KE0505	2-methyl-2-butanone
KE0601	3-hexanone

The significance of the ID number will be explained later; here it is just used as a convenient tag for the compounds in Table 4 where the test results for the various correlations are summarized.

The BCON printout gives the root-mean-squared deviation for each set of literature data for each correlation tested. Those values are listed in Table 4. BCON also gives the rmsd value for the combined data sets for each compound but that number is not very useful because the individual data sets vary in quality and the selection of the best correlation must be based on those few data sets which are felt to be of the highest quality.

Table 4. Correlation test results for second virial coefficient data

ID	Reference number	Root-mean-squared-deviation for data set					
		Kreglewski	Pitzer	O'Connell	Tsonopoulos	Nothnagel	Hayden
KE0300	1257	176	480	190	168	199	129*
KE0300	1803	46	247	45	24*	96	38
KE0300	1950	147*	972	548	265	148	277
KE0300	2422	84	261	117	96	67*	115
KE0300	2678	35	294	74	24*	69	51
KE0300	5214	80	460	137	107	95	67*
KE0300	5283	72	307	48	45*	77	72
KE0300	5948	15*	378	115	50	32	52
KE0300	8330	71	676	282	62	59*	70
KE0300	8577	19*	524	194	80	32	71
KE0300	9027	145	493	260	181	124*	188
KE0300	10972	47	360	42	12*	49	46
KE0300	20469	46	247	45	24*	96	38
KE0400	10901	28*	327	462	83	59	28
KE0400	21584	96	332	452	64*	121	89
KE0500	10901	37*	471	701	164	607	369
KE0501	4033	180	430		21*		87
KE0501	21584	124	219		92*		103
KE0505	4033	185	316		140*		
KE0601	4033		359		29*		

The correlation equation which gave the lowest rmsd value for each set of data is indicated by an asterisk on that lowest value in Table 4. The Tsonopoulos equation was the best performer, giving the lowest rmsd for 10 of the 20 literature data sets. The Kreglewski correlation was the second best performer with the lowest rmsd for 5 sets of data. However, the use of the Kreglewski correlation is restricted to pure compound calculations because there are no mixing rules for mixture calculations, hence it is of less intrinsic interest than the other correlations.

Comparison of the rmsd for all the literature data sets can be misleading because the best correlation should not give the lowest rmsd for a bad set of data. Of the 13 literature data sets for acetone (KE0300), Dymond and Smith [41648] favor the Hajjar et al. [1803], Bottomley et al. [2678] and Knoebel et al. [5948] sets, with preference given to the first two sets above 360 K. The Tsonopoulos correlation gives the lowest rmsd for the first two while the Nothnagel et al. equation fits the third set best, hence the Tsonopoulos equation was chosen for acetone.

For 2-butanone (KE0400), the Hayden-O'Connell correlation's rmsd was lower than that of the Tsonopoulos equation for the Nickerson et al. [10901], and also lower for the combined Nickerson et al. and the Chang et al. [21584] set. Hence, the Hayden-O'Connell correlation was chosen for 2-butanone.

The Tsonopoulos correlation was chosen for all of the rest of the compounds in Table 4. The Kreglewski correlation represented the 2-pentanone data much better but, because of the lack of mixture mixing rules, that equation is never chosen for storage in the data bank.

5. Selected Values

The objective was to select the best values from all the available literature data for each relevant compound-property combination. For heavily-measured compounds, the selected values should be quite accurate. For sparsely-measured compounds, the selected values often have little to recommend them other than the fact that they appear to be the best of the limited information available.

Table 5 lists those compounds for which enough information was found to merit inclusion in this report. Table 5 also gives the identification numbers which are used to identify the compounds in succeeding tables. The first two characters of the "number" are always alphabetical and represent the compound class (KE for ketones, OH for alcohols, etc.). The second two characters are related to the carbon number as shown in Table 6. It was possible to use the carbon number as the second two characters only through 8. For carbon numbers 9 and 10, more than 100 numbers has been needed for some compound classes. The ranges for those two carbon numbers were made overly large in order to get back to a more obvious relationship between carbon number and the identification number starting with carbon number 11.

Chemical nomenclature is a serious problem when retrieving information from a computer data bank. To alleviate that problem, up to four different compound names can be stored with each compound record. Table 5 lists all the names used for each compound.

Table 5. Compound identification numbers

KE0300	ACETONE
KE0300	2-PROPANONE
KE0305	HEXADEUTEROACETONE
KE0305	ACETONE-D(6)
KE0340	1-HYDROXY-2-PROPANONE
KE0340	ACETYLCARBINOL
KE0360	1-CHLORO-2-PROPANONE
KE0360	CHLOROACETONE
KE0361	1,1-DICHLORO-2-PROPANONE
KE0361	1,1-DICHLOROACETONE
KE0362	1,3-DICHLORO-2-PROPANONE
KE0362	1,3-DICHLOROACETONE
KE0370	1-CHLORO-1,1,3,3,3-PENTAFLUORO-2-PROPANONE
KE0370	PENTAFLUOROCHLOROACETONE
KE0370	CHLOROPENTAFLUOROACETONE
KE0380	1,1,1,3,3,3-HEXAFLUORO-2-PROPANONE
KE0380	PERFLUOROACETONE
KE0380	HEXAFLUOROACETONE
KE0400	2-BUTANONE
KE0400	METHYL ETHYL KETONE
KE0400	ETHYL METHYL KETONE
KE0410	2,3-BUTANEDIONE
KE0410	BIACETYL
KE0410	DIACETYL
KE0420	CYCLOBUTANONE
KE0430	1,3-CYCLOBUTANEDIONE
KE0430	CYCLOBUTAN-1,3-DIONE
KE0440	3-BUTEN-2-ONE
KE0440	METHYL VINYL KETONE
KE0440	VINYL METHYL KETONE
KE0445	3-HYDROXY-2-BUTANONE
KE0445	ACETOIN
KE0445	ACETYL METHYL CARBINOL
KE0446	4-HYDROXY-2-BUTANONE
KE0446	3-KETOBUTANOL
KE0450	1-BROMO-2-BUTANONE
KE0450	BROMOMETHYL ETHYL KETONE
KE0451	3-BROMO-2-BUTANONE
KE0451	METHYL 1-BROMOETHYL KETONE
KE0460	3-CHLORO-2-BUTANONE
KE0460	3-CHLOROBUTANONE-2
KE0500	2-PENTANONE
KE0500	METHYL N-PROPYL KETONE
KE0500	METHYL PROPYL KETONE
KE0501	3-PENTANONE
KE0501	DIETHYL KETONE
KE0501	PROPIONE
KE0505	3-METHYL-2-BUTANONE
KE0505	ISOPROPYL METHYL KETONE

Table 5. Compound identification numbers--Continued

KE0505	METHYL ISOPROPYL KETONE
KE0510	2,4-PENTANEDIONE
KE0510	ACETYLACETONE
KE0510	DIACETYLMETHANE
KE0520	CYCLOPENTANONE
KE0520	ADIPIC KETONE
KE0520	KETOPENTAMETHYLENE
KE0530	ACETYLCYCLOPROPANE
KE0530	METHYL CYCLOPROPYL KETONE
KE0530	CYCLOPROPYL METHYL KETONE
KE0530	1-CYCLOPROPYL-1-ETHANONE
KE0540	3-METHYL-3-BUTEN-2-ONE
KE0540	METHYL ISOPROPENYL KETONE
KE0555	4-BROMO-2-PENTANONE
KE0555	2-BROMOPROPYL METHYL KETONE
KE0563	1-HYDROXY-3-METHYL-2-BUTANONE
KE0563	BETA-METHYL-ALPHA-KETOBUTANOL
KE0565	3-HYDROXY-3-METHYL-2-BUTANONE
KE0566	4-HYDROXY-3-METHYL-2-BUTANONE
KE0568	1-HYDROXY-4-METHOXY-2-BUTANONE
KE0570	5-HYDROXY-3-PENTYN-2-ONE
KE0570	1-HYDROXY-2-PENTYNE-4-ONE
KE0600	2-HEXANONE
KE0600	METHYL BUTYL KETONE
KE0600	BUTYL METHYL KETONE
KE0601	3-HEXANONE
KE0601	ETHYL PROPYL KETONE
KE0604	4-METHYL-2-PENTANONE
KE0604	ISOBUTYL METHYL KETONE
KE0604	METHYL ISOBUTYL KETONE
KE0604	ISOPROPYL ACETONE
KE0605	2-METHYL-3-PENTANONE
KE0605	ETHYL ISOPROPYL KETONE
KE0607	3,3-DIMETHYL-2-BUTANONE
KE0607	TERT-BUTYL METHYL KETONE
KE0607	PINACOLONE
KE0607	PINACOLIN
KE0610	2,5-HEXANEDIONE
KE0610	ACETONYL ACETONE
KE0615	3-METHYL-2,4-PENTANEDIONE
KE0615	METHYLACETYLACETONE
KE0620	CYCLOHEXANONE
KE0620	KETOHEXAMETHYLENE
KE0620	PIMELIC KETONE
KE0625	3-METHYLCYCLOPENTANONE
KE0640	5-HEXEN-2-ONE
KE0640	ALLYLACETONE
KE0645	4-METHYL-4-PENTEN-2-ONE
KE0645	ISOMESITYL OXIDE
KE0650	4-METHYL-3-PENTEN-2-ONE
KE0650	ISOPROPYLIDENEACETONE

Table 5. Compound identification numbers--Continued

KE0650	MESITYL OXIDE
KE0660	2,5-CYCLOHEXADIENE-1,4-DIONE
KE0660	1,4-BENZOQUINONE
KE0660	P-QUINONE
KE0660	P-BENZOQUINONE
KE0670	4-HYDROXY-4-METHYL-2-PENTANONE
KE0670	DIACETONE ALCOHOL
KE0680	6-BROMO-2-HEXANONE
KE0680	6-BROMOHEXANE-2-ONE
KE0700	2-HEPTANONE
KE0700	METHYL AMYL KETONE
KE0700	METHYL PENTYL KETONE
KE0701	3-HEPTANONE
KE0701	ETHYL BUTYL KETONE
KE0701	BUTYL ETHYL KETONE
KE0702	4-HEPTANONE
KE0702	DIPROPYL KETONE
KE0710	2-METHYL-3-HEXANONE
KE0710	PROPYL ISOPROPYL KETONE
KE0720	2,4-DIMETHYL-3-PENTANONE
KE0720	DIISOPROPYL KETONE
KE0720	TETRAMETHYLACETONE
KE0720	ISOBUTYRONE
KE0725	3,3-DIMETHYL-2,4-PENTANEDIONE
KE0725	DIMETHYL ACETYL ACETONE
KE0730	3-ETHYL-2,4-PENTANEDIONE
KE0730	ETHYL ACETYL ACETONE
KE0735	2,4,6-HEPTANETRIONE
KE0735	DIACETYL ACETONE
KE0740	CYCLOHEPTANONE
KE0745	2-METHYL-1-CYCLOHEXANONE
KE0745	2-METHYLCYCLOHEXANONE
KE0746	3-METHYL-1-CYCLOHEXANONE
KE0746	3-METHYLCYCLOHEXANONE
KE0747	4-METHYL-1-CYCLOHEXANONE
KE0747	4-METHYLCYCLOHEXANONE
KE0760	2-METHYL-2,5-CYCLOHEXADIENE-1,4-DIONE
KE0760	2-METHYL-1,4-BENZOQUINONE
KE0760	METHYL P-BENZOQUINONE
KE0800	2-OCTANONE
KE0800	METHYL HEXYL KETONE
KE0801	3-OCTANONE
KE0801	ETHYL AMYL KETONE
KE0802	4-OCTANONE
KE0802	PROPYL BUTYL KETONE
KE0810	2-METHYL-3-HEPTANONE
KE0810	ISOPROPYL BUTYL KETONE
KE0830	2,5-DIMETHYL-3-HEXANONE
KE0830	ISOPROPYL ISOBUTYL KETONE
KE0850	2,2,4-TRIMETHYL-3-PENTANONE
KE0870	ACETYLCYCLOHEXANE

Table 5. Compound identification numbers--Continued

KE0870	1-CYCLOHEXYL-1-ETHANONE
KE0870	METHYL CYCLOHEXYL KETONE
KE0890	CYCLOOCTANONE
KE0910	2-PROPYL-1-CYCLOPENTANONE
KE0910	ALPHA-PROPYLCYCLOPENTANONE
KE0930	3-ACETYL-5-HEXEN-2-ONE
KE0930	ALLYL ACETYL ACETONE
KE0950	ACETOPHENONE
KE0950	1-PHENYLETHANONE
KE0950	METHYL PHENYL KETONE
KE0950	ACETYLBENZENE
KE0980	4-CHLOROACETOPHENONE
KE0980	P-CHLOROACETOPHENONE
KE0980	P-CHLOROPHENYL METHYL KETONE
KE1000	2-NONANONE
KE1000	METHYL HEPTYL KETONE
KE1001	3-NONANONE
KE1001	ETHYL N-HEXYL KETONE
KE1002	4-NONANONE
KE1002	PROPYL AMYL KETONE
KE1002	AMYL PROPYL KETONE
KE1003	5-NONANONE
KE1003	DIBUTYL KETONE
KE1003	NONAN-5-ONE
KE1020	2,6-DIMETHYL-4-HEPTANONE
KE1020	DIISOBUTYL KETONE
KE1040	2,2,4,4-TETRAMETHYL-3-PENTANONE
KE1040	HEXAMETHYL ACETONE
KE1060	1-CYCLOHEXYL-1-PROPANONE
KE1100	CYCLONONANONE
KE1150	2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE
KE1150	PHORONE
KE1150	DIISOPROPYLIDENEACETONE
KE1180	1-PHENYL-1-PROPANONE
KE1180	PROPIOPHENONE
KE1180	ETHYL PHENYL KETONE
KE1180	PHENYL ETHYL KETONE
KE1181	1-PHENYL-2-PROPANONE
KE1181	BENZYL METHYL KETONE
KE1181	PHENYL ACETONE
KE1181	ACETONYLBENZENE
KE1200	4-METHYLACETOPHENONE
KE1200	P-TOLYL METHYL KETONE
KE1200	P-METHYLACETOPHENONE
KE1250	1-INDANONE
KE1250	ALPHA-HYDRINDONE
KE1320	1-(2,2-DIMETHYLCYCLOPROPYL)-2-HYDROXY-1-PROPANONE
KE1320	KETOL
KE1350	3,5-DIBROMO-2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE
KE1350	ALPHA,ALPHA'-DIBROMOPHORONE
KE1360	3,5-DICHLORO-2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE

Table 5. Compound identification numbers--Continued

KE1360	ALPHA,ALPHA'-DICHLOROPHORONE
KE1400	2-DECANONE
KE1400	METHYL OCTYL KETONE
KE1401	3-DECANONE
KE1401	ETHYL N-HEPTYL KETONE
KE1403	5-DECANONE
KE1403	BUTYL AMYL KETONE
KE1500	CYCLODECANONE
KE1530	2-ISOPROPYL-5-METHYL-1-CYCLOHEXANONE
KE1530	L-METHONE
KE1530	L-P-MENTHAN-3-ONE
KE1530	1-METHYL-4-ISOPROPYLCYCLOHEXAN-3-ONE
KE1550	2,2,5,5-TETRAMETHYL-1-CYCLOHEXANONE
KE1550	1,1,4,4-TETRAMETHYLCYCLOHEXANONE-2
KE1580	DECAHYDRO-2-NAPHTHALENONE
KE1580	TRANS-BETA-DECALONE
KE1600	1,3,3-TRIMETHYLBICYCLO(2.2.1)HEPTAN-2-ONE
KE1600	FENCHONE
KE1600	1,3,3-TRIMETHYL-2-NORCAMPHANONE
KE1620	CAMPHOR
KE1620	2-CAMPHANONE
KE1620	1,7,7-TRIMETHYLBICYCLO(2.2.1)HEPTAN-2-ONE
KE1640	(1S)-1-ALPHA-ISOPROPYL-4-METHYLBICYCLO(3.1.0)HEXAN-3-ONE
KE1640	ALPHA-THUJONE
KE1640	3-THUJANONE
KE1640	TANACETONE
KE1660	3-ISOPROPYL-6-METHYL-2-CYCLOHEXEN-1-ONE
KE1660	CARVENONE
KE1660	6-METHYL-3-(1-METHYLETHYL)-2-CYCLOHEXEN-1-ONE
KE1680	5-ISOPROPYL-3-METHYL-2-CYCLOHEXEN-1-ONE
KE1680	1-METHYL-3-ISOPROPYLCYCLOHEXEN-6-ONE-5
KE1700	5-ISOPROPENYL-2-METHYL-2-CYCLOHEXEN-1-ONE
KE1700	CARVONE
KE1700	2-METHYL-5-(1-METHYLETHENYL)-2-CYCLOHEXEN-1-ONE
KE1720	1-OXO-1,2,3,4-TETRAHYDRONAPHTHALENE
KE1720	ALPHA-TETRALONE
KE1720	3,4-DIHYDRO-1(2H)-NAPHTHALENONE
KE1750	1-PHENYL-1-BUTANONE
KE1750	PHENYL PROPYL KETONE
KE1750	PROPYL PHENYL KETONE
KE1750	BUTYROPHENONE
KE1760	1-PHENYL-2-BUTANONE
KE1760	BENZYL ETHYL KETONE
KE1762	4-PHENYL-2-BUTANONE
KE1762	BENZYL ACETONE
KE1762	METHYL-2-PHENYLETHYL KETONE
KE1800	3,5-DIMETHYLACETOPHENONE
KE1820	3-ETHYLACETOPHENONE
KE1820	M-ETHYLACETOPHENONE
KE1821	4-ETHYLACETOPHENONE
KE1821	P-ETHYLACETOPHENONE

Table 5. Compound identification numbers--Continued

KE1860	1-PHENYL-1,3-BUTANEDIONE
KE1860	BENZOYLACETONE
KE1900	1,3-DIACETYLBENZENE
KE1900	M-DIACETYLBENZENE
KE1901	1,4-DIACETYLBENZENE
KE1901	P-DIACETYLBENZENE
KE2000	5-BROMO-3-METHOXY-2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE
KE2000	ALPHA-BROMO-ALPHA'-METHOXYPHORONE
KE2100	2-UNDECANONE
KE2100	2-HENDECANONE
KE2100	METHYL N-NONYL KETONE
KE2104	6-UNDECANONE
KE2104	DI-N-AMYL KETONE
KE2104	UNDECAN-6-ONE
KE2104	DIAMYL KETONE
KE2120	CYCLOUNDECANONE
KE2130	3-ACETOXY-2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE
KE2130	ALPHA-ACETOXYPHORONE
KE2150	1-PHENYL-1-PENTANONE
KE2150	N-BUTYL PHENYL KETONE
KE2150	VALEROPHENONE
KE2150	PHENYL BUTYL KETONE
KE2155	1-PHENYL-2-PENTANONE
KE2155	BENZYL N-PROPYL KETONE
KE2170	2,2-DIMETHYL-1-INDANONE
KE2170	BETA,BETA-DIMETHYL-ALPHA-HYDRINDON
KE2190	3-ACETOXY-5-BROMO-2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE
KE2190	ALPHA-BROMO-ALPHA'-ACETOXYPHORONE
KE2225	CYCLODODECANONE
KE2235	5,5-DIETHYL-2,2-DIMETHYL-1-CYCLOHEXANONE
KE2235	1,1-DIMETHYL-4,4-DIETHYLCYCLOHEXANONE-2
KE2250	1-PHENYL-1-HEXANONE
KE2250	N-AMYL PHENYL KETONE
KE2250	CAPROPHENONE
KE2260	1-ACETYLNAPHTHALENE
KE2260	1-ACETONAPHTHONE
KE2260	METHYL 1-NAPHTHYL KETONE
KE2261	2-ACETYLNAPHTHALENE
KE2261	2-ACETONAPHTHONE
KE2261	METHYL 2-NAPHTHYL KETONE
KE2300	2-TRIDECANONE
KE2300	UNDECYL METHYL KETONE
KE2300	METHYL UNDECYL KETONE
KE2300	HENDECYL METHYL KETONE
KE2330	4-(2,6,6-TRIMETHYL-2-CYCLOHEXEN-1-YL)-3-BUTEN-2-ONE
KE2330	ALPHA-IONONE
KE2331	4-(2,6,6-TRIMETHYL-1-CYCLOHEXEN-1-YL)-3-BUTEN-2-ONE
KE2331	BETA-IONONE
KE2350	1-PHENYL-1-HEPTANONE
KE2350	ENANTHOPHENONE
KE2350	HEXYL PHENYL KETONE

Table 5. Compound identification numbers--Continued

KE2365	BENZOPHENONE
KE2365	DIPHENYL KETONE
KE2365	BENZOYL BENZENE
KE2365	DIPHENYLMETHANONE
KE2380	1-NAPHTHYL-1-PROPANONE
KE2380	1-PROPIONAPHTHONE
KE2380	ETHYL 1-NAPHTHYL KETONE
KE2430	DIPHENYLETHANEDIONE
KE2430	BENZIL
KE2430	BIBENZOYL
KE2430	DIPHENYL-ALPHA,BETA-DIKETONE
KE2445	1-(1-NAPHTHALENYL)-1-BUTANONE
KE2445	N-PROPYL 1-NAPHTHYL KETONE
KE2460	9,10-ANTHRACENEDIONE
KE2460	9,10-ANTHRAQUINONE
KE2460	9,10-DIOXOANTHRACENE
KE2460	ANTHRAQUINONE
KE2473	1,4-DIHYDROXY-9,10-ANTHRACENEDIONE
KE2473	QUINIZARIN
KE2473	1,4-DIHYDROXYANTHRAQUINONE
KE2474	1,5-DIHYDROXY-9,10-ANTHRACENEDIONE
KE2474	1,5-DIHYDROXYANTHRAQUINONE
KE2477	1,8-DIHYDROXY-9,10-ANTHRACENEDIONE
KE2477	1,8-DIHYDROXYANTHRAQUINONE
KE2506	8-PENTADECANONE
KE2506	DI-N-HEPTYL KETONE
KE2506	N-DIHEPTYL KETONE
KE2506	PENTADECANE-8-ONE
KE2540	1-PHENYL-1-NONANONE
KE2540	N-OCTYL PHENYL KETONE
KE2545	1,3-DIPHENYL-2-PROPANONE
KE2545	DIBENZYL KETONE
KE2565	1-(1-NAPHTHALENYL)-1-PENTANONE
KE2565	N-BUTYL 1-NAPHTHYL KETONE
KE2630	3-BENZOYLOXY-2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE
KE2630	ALPHA-BENZOYLOXYPHORONE
KE2645	1-(1-NAPHTHALENYL)-1-HEXANONE
KE2645	N-PENTYL 1-NAPHTHYL KETONE
KE2680	3-(4-BROMOBENZYLOXY)-2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE
KE2680	ALPHA-P-BROMOBENZYLOXYPHORONE
KE2685	5-BROMO-3(4-BROMOBENZYLOXY)-2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE
KE2685	ALPHA-BROMO-ALPHA'-P-BROMOBENZYLOXYPHORONE
KE2688	3-BENZOYLOXY-5-BROMO-2,6-DIMETHYL-2,5-HEPTADIEN-4-ONE
KE2688	ALPHA-BROMO-ALPHA'-BENZOYLOXYPHORONE
KE2707	9-HEPTADECANONE
KE2707	DIOCTYL KETONE
KE2707	N-HEPTADECANONE-9
KE2745	1,5-DIPHENYL-1,4-PENTADIEN-3-ONE
KE2745	DIBENZALACETONE
KE2745	DISTYRYL KETONE
KE2755	1-(1-NAPHTHALENYL)-1-HEPTANONE

Table 5. Compound identification numbers--Continued

KE2755	N-HEXYL 1-NAPHTHYL KETONE
KE2755	HEPTANONAPHTHONE
KE2775	7H-BENZ(DE)ANTHRACEN-7-ONE
KE2775	BENZANTHRONE
KE2835	1-PHENYL-1-DODECANONE
KE2835	N-UNDECYL PHENYL KETONE
KE2835	PHENYL UNDECYL KETONE
KE2845	1-NAPHTHYL-1-OCTANONE
KE2845	N-HEPTYL 1-NAPHTHYL KETONE
KE2845	OCTANONAPHTHONE
KE2845	CAPRYLONAPHTHONE
KE3050	1-PHENYL-1-TETRADECANONE
KE3050	N-TRIDECYL PHENYL KETONE
KE3050	PHENYL TRIDECYL KETONE
KE3310	12-TRICOSANONE
KE3310	DIUNDECYL KETONE
KE3310	LAURONE
KE3350	1-PHENYL-1-HEXADECANONE
KE3350	PENTADECYL PHENYL KETONE
KE3350	PALMITOPHENONE
KE3712	14-HEPTACOSANONE
KE3712	DITRIDECYL KETONE
KE3712	MYRISTONE
KE4114	16-HENTRIACONTANONE
KE4114	DIPENTADECYL KETONE
KE4114	PALMITONE
KE4516	18-PENTATRIACONTANONE
KE4516	DIHEPTADECYL KETONE
KE4516	STEARONE

Table 6. Relation between carbon number and the assigned compound identification number

Carbon number	Identification number	Carbon number	Identification number	Carbon number	Identification number
1	0100-0199	11	2100-2199	21	3100-3199
2	0200-0299	12	2200-2299	22	3200-3299
3	0300-0399	13	2300-2399	23	3300-3399
4	0400-0499	14	2400-2499	24	3400-3499
5	0500-0599	15	2500-2599	25	3500-3599
6	0600-0699	16	2600-2699	26	3600-3699
7	0700-0799	17	2700-2799	27	3700-3799
8	0800-0999	18	2800-2899	28	3800-3899
9	1000-1399	19	2900-2999	29	3900-3999
10	1400-2099	20	3000-3099	30	4000-4099
				31	4100-4199
				32	4200-4299
				33	4300-4399
				34	4400-4499
				35	4500-4599

A compound was included in Table 5 only if there was enough information to establish a temperature correlation for either vapor pressure or liquid density. To do that, there had to be at least two useable data points for at least one of those two properties. For example, liquid density values at 20° and 25 °C which gave a reasonable slope were sufficient to put a compound on the list even when no other data were available.

5.1. Compound Constants

The selected values of the compound constants are listed in Table 7. The 20 and 25 °C liquid density values are not included in the tabulation in order to make room for the dipole moment and radius of gyration, both of which are often needed for physical property correlations.

5.1.1. Formula Weight

The atomic weights were taken from "Atomic Weights of the Elements 1975", Inorganic Chemistry Division Commission on Atomic Weights, International Union of Pure and Applied Chemistry, published in Pure and Applied Chemistry, 47, 75-95 (1976).

Carbon	12.011
Hydrogen	1.0079
Deuterium	2.016
Bromine	79.904
Chlorine	35.453
Fluorine	18.998403
Iodine	126.9045
Nitrogen	14.0067
Oxygen	15.9994

Table 7. Compound constant values

ID	FW	MP, K	NBP, K	TC, K	PC, MPa	VC, ml/mol	ZC	ω	μ, Debye	R, °A
KE0300	58.080	178.476	329.207	508.100	4.700	208.921	0.232	0.3073	2.86	2.7404
KE0305	64.128									
KE0340	74.079									
KE0360	92.525		391.656						2.38	
KE0361	126.970		391.656							
KE0362	126.970	316.139	445.185							
KE0370	182.477	140.141	280.948	410.665	2.878			0.3449		4.0101
KE0380	166.023	147.698	245.805	357.245	2.841	329.084	0.313	0.3649		3.8076
KE0400	72.107	186.490	352.747	536.780	4.207	267.063	0.251	0.3220	2.78	3.1395
KE0410	86.090		361.853						1.46	
KE0420	70.091	222.179	371.990						2.61	2.7906
KE0430	84.074	265.454	399.650							
KE0440	70.091		354.703						3.00	
KE0445	88.106		416.551							
KE0446	88.106		455.150							
KE0450	151.003		427.659						2.35	
KE0451	151.003		409.159							
KE0460	106.552		388.742							
KE0500	86.133	196.320	375.408	561.080	3.694	301.164	0.238	0.3470	2.72	
KE0501	86.133	234.203	375.109	561.460	3.729	336.457	0.268	0.3410	2.72	3.4817
KE0505	86.133	181.178	367.482	553.400	3.850	309.831	0.259	0.3301	2.77	3.4148
KE0510	100.117	249.964	411.855						2.81	
KE0520	84.118	221.879	403.706							3.1662
KE0530	84.118	204.883	384.870						2.87	
KE0540	84.118	219.580	370.904						2.77	
KE0555	165.030									
KE0563	102.133		462.775							
KE0565	102.133		416.404							
KE0566	102.133		458.142							
KE0568	118.132									
KE0570	98.101									
KE0600	100.160	217.381	400.733	587.000	3.323			0.3942	2.68	
KE0601	100.160	217.531	396.656	582.820	3.320			0.3794		
KE0604	100.160	189.181	388.856	571.000	3.270			0.3663		
KE0605	100.160		388.032							
KE0607	100.160	221.179	379.263	567.000	3.470			0.3229	2.81	
KE0610	114.144	264.155								
KE0615	114.144									
KE0620	98.144	241.969	428.763	629.000	3.850			0.4524	3.08	
KE0625	98.144	214.782								
KE0640	98.144		402.144							
KE0645	98.144		394.648							
KE0650	98.144		402.959						3.24	
KE0660	108.096	388.655							.68	
KE0670	116.160	226.177	441.076						3.24	
KE0680	179.056		490.027							
KE0700	114.187	238.171	424.206	611.500	3.436			0.4857	2.61	

Table 7. Compound constant values--Continued

KE0701	114.187	234.173	420.569					2.81
KE0702	114.187	240.669	417.259					2.50
KE0710	114.187		406.531					
KE0720	114.187	204.183	396.818					2.73
KE0725	128.171							
KE0730	128.171							
KE0735	142.154							
KE0740	112.171		453.558					3.10
KE0745	112.171	259.258						
KE0746	112.171	199.683						
KE0747	112.171	232.574						
KE0760	122.123	340.141						
KE0800	128.214	252.862	446.425					2.72
KE0801	128.214		440.863					
KE0802	128.214							
KE0810	128.214		428.531					
KE0830	128.214		418.732					
KE0850	128.214	244.147	408.131					
KE0870	126.198							
KE0890	126.198	317.350	474.612					2.96
KE0910	126.198	204.933	456.335					
KE0930	140.182							
KE0950	120.151	292.742	475.020					2.96
KE0980	154.596	291.543	510.208					2.34
KE1000	142.241	265.654	468.465					
KE1001	142.241							
KE1002	142.241							
KE1003	142.241	267.253	461.590	640.000	2.320		0.5138	2.69
KE1020	142.241	227.137	441.414					2.66
KE1040	142.241	247.925	426.700					2.64
KE1060	140.225							
KE1100	140.225	305.050	493.570					2.85
KE1150	138.209	301.141	470.391					2.38
KE1180	134.177	291.753	490.914					2.88
KE1181	134.177	257.759						2.72
KE1200	134.177		497.474					3.23
KE1250	132.162							3.41
KE1320	156.224							
KE1350	296.001	305.140						
KE1360	207.099							
KE1400	156.267	276.248	483.296					
KE1401	156.267							
KE1403	156.267							
KE1500	154.252	295.950						2.75
KE1530	154.252	266.603						2.83
KE1550	154.252							
KE1580	152.236							
KE1600	152.236	278.147	466.413					2.93
KE1620	152.236	452.683	480.706					2.98
KE1640	152.236		474.193					
KE1660	152.236							

Table 7. Compound constant values--Continued

KE1680	152.236			
KE1700	150.220		502.086	
KE1720	146.188			
KE1750	148.204		502.000	2.83
KE1760	148.204			
KE1762	148.204			
KE1800	148.204			
KE1820	148.204			
KE1821	148.204	248.914		
KE1860	162.188	331.640		
KE1900	162.188	303.640		
KE1901	162.188	386.655		2.74
KE2000	247.131			
KE2100	170.294	285.944	506.295	2.70
KE2104	170.294	287.744	500.554	2.68
KE2120	168.278			
KE2130	196.246			
KE2150	162.231	264.155		
KE2155	162.231			
KE2170	160.215			
KE2190	275.142			
KE2225	182.305	335.550	549.670	2.75
KE2235	182.305			
KE2250	176.258	300.141	538.400	
KE2260	170.210		568.721	
KE2261	170.210	328.640	573.150	
KE2300	198.348	300.641	541.172	
KE2330	192.300		523.204	
KE2331	192.300			3.50
KE2350	190.285	290.143	544.516	
KE2365	182.221	320.989	579.097	2.98
KE2380	184.237		579.223	
KE2430	210.232	368.148	620.160	3.71
KE2445	198.264			
KE2460	208.216	558.019	649.984	
KE2473	240.215	467.190	723.129	
KE2474	240.215			
KE2477	240.215			
KE2506	226.401	312.389	567.786	2.73
KE2540	218.338	287.144		
KE2545	210.275	307.640	604.154	2.81
KE2565	212.291			
KE2630	258.316			
KE2645	226.318			
KE2680	323.229			
KE2685	402.125			
KE2688	337.213			
KE2707	254.455	326.139		2.40
KE2745	234.297	385.154		3.30
KE2755	240.344			
KE2775	230.265	447.181		3.41

Table 7. Compound constant values--Continued

KE2835	260.419	317.639		
KE2845	254.371			
KE3050	288.472	325.639		
KE3310	338.616	342.441		2.50
KE3350	316.526	332.140		
KE3712	394.723	350.343		2.32
KE4114	450.830	356.844		
KE4516	506.937	361.846		

5.1.2. Melting Point

Melting and freezing point values were transcribed along with the other properties and listed by program CONCON. However, the values selected for tabulation in Table 7 were usually obtained from the TRC Tables [3270]. A value from another source was used only in those few instances when a high-quality value published later than the TRC table appeared to provide better information. No attempt was made to apply any external checks to the melting point values, such as plotting the values for homologs versus carbon number. No distinction was made between freezing and melting point values; both are listed in Table 7 as melting point (MP) values.

A few triple point values were found in the literature but more often than not the relation to the corresponding melting point appeared anomalous. Hence the decision not to include the triple point values in Table 7.

5.1.3. Normal Boiling Point

As explained in section 4.1 and 4.2.3, the normal boiling point values listed in Table 7 are those calculated from the final vapor pressure fits for either range 2 or range 4. Table 8 shows how the final selected values differ from the ketone values given in Ambrose [10318, 41765] and the TRC tables [3270]. When normal boiling point values appeared in Ambrose [41765], they were chosen as the tentative selected values and used as a guideline in the vapor pressure data fitting, hence our values are biased toward the Ambrose values.

Table 8. Comparison of selected normal boiling points with those of other compilations

Compound	This report	Other compilations Ambrose [41765]	TRC [3270]
KE0300	329.207	329.200	329.429
KE0400	352.747	352.740	352.784
KE0500	375.408	375.410	375.460
KE0501	375.109	375.110	375.140
KE0505	367.482	367.480	367.548
KE0600	400.733	400.700	400.860
KE0601	396.656	396.600	396.658
KE0604	388.856	389.600	389.656
KE0605	388.032		386.554
KE0607	379.263	379.263 [10318]	379.452
KE0620	428.763	428.900	
KE0700	424.206	424.200	424.070
KE0701	420.569		420.569
KE0702	417.259		417.167
KE0710	406.531		406.163
KE0720	396.818		397.559
KE0800	446.425		445.780
KE1000	468.465		467.490
KE1400	483.296		483.296
KE2100	506.295	506.300 [10318]	501.103
KE2300	541.172	541.200 [10318]	536.215

In Table 8, the differences between the final selected values and those listed by Ambrose or the TRC tables are large enough to merit discussion for seven compounds: KE0605, KE0710, KE0720, KE0800, KE1000, KE2100 and KE2300.

For KE0605, the input to program CONCON included three normal boiling point values besides the value from the TRC table. Those values were 387.655 from Bryant et al. [8181], 388.255 from Ginnings et al. [13065] and 388.155 from Jamison et al. [21544]. All three were retained for the final correlation along with 9 points from Loginova et al. [15776] over the range from 300.15 to 382.15. Hence, all the information found supports the 388.032 K value rather than the lower TRC value.

No normal boiling point values were found for KE0710. The only vapor pressure data found was an equation from Mayberry and Aston [13799] which gave 406.531 for the normal boiling point. There is no particular reason to believe that value is any better than the 406.163 K value given by the TRC tables.

For KE0720, 10 normal boiling point values were found in the literature and those values scattered around the TRC value of 397.55. Our vapor pressure correlation is based upon points calculated from the equation of Mayberry and Aston [13799] over the range 350 to 440 K, and on points from Dreisbach and Shrader [1361] from 293 to 344 K. The Dreisbach and Shrader value for the normal boiling point was 398.409 whereas the Mayberry and Aston equation gives 396.818. The Mayberry et al. vapor pressure data were chosen over the Driesbach et al. data in the 350 to 400 K range, primarily because the latter ended at the normal boiling point while the former could be extrapolated (rightly or wrongly) above the normal boiling point. The true normal boiling point probably lies between the Mayberry et al. and the Driesbach et al. values in the vicinity of the 397.559 value given by the TRC tables.

With the exception of two values which were about 3 K below all the other values, all other literature values retrieved (six of them) for the normal boiling point of KE0800 were above 446 K. The final vapor pressure correlations were based on the vapor pressure data of Geisler and Ratzsch [18439] and the boiling point values reported by Deffet [5736] (446.681 K), Bruhl [5842] (100.352 kPa at 446.080 K), Ceuterick [9712] (100.658 kPa at 446.180 K), Mironenko et al. [15791] (446.250 K) and Lecat [21283] (446.030 K). It is believed that the TRC table value is slightly low for KE0800.

For KE2100 and KE2300, the more recent data of Ambrose et al. [10318] supersedes the older TRC values.

5.1.4. Critical Properties

Values for one or more critical properties were found for 14 compounds: KE0300, KE0370, KE0380, KE0400, KE0500, KE0501, KE0505, KE0600, KE0601, KE0604, KE0607, KE0620, KE0700, and KE1003. Ambrose [41765] lists selected values for all of these compounds except for the two halogenated ketones KE0370 and KE0380. No reason was found to change the values selected by Ambrose.

The compilation of Kudchadker, Alani and Zwolinski [1051] lists the T_c and P_c values of Murphy [10015] for KE0370. Those values are evidently the only existing ones. Also, the only vapor pressure data set for KE0370 is from Murphy.

Kudchadker et al. also selected Murphy's [10015] T_c and P_c values for KE0380 because they were the only values available at the time. The values which have appeared since then are listed below with Murphy's values.

	T_c, K	P_c, MPa
Murphy [10015]	357.245	2.841
Plaush and Pace [15034]	357.245	2.834
Glowka and Zawisza [16255]	357.185	2.837
Mousa, Kay and Kreglewski [7465]	357.135	2.832
Mousa [40009]	357.135	2.832

The values of Mousa [40009] were selected initially. However, the Murphy T_c and P_c values worked a little better with the available vapor pressure values near the critical point and were chosen as the final selected values.

When P_c, T_c and V_c were all available, Z_c was calculated using $R = 0.00831441$ MPa cm^3/mol K.

5.1.5. Acentric Factor

The acentric factor was calculated for every compound with T_c and P_c values. The calculation was automatically done by program PFIT for every vapor pressure fit. The acentric factor value selected for the compound was the one from the correlation used to calculate the final normal boiling point if $T_r = 0.7$ fell within the temperature range of that correlation. In some instances when the normal boiling point was obtained from the range 2 fit, it was necessary to use the acentric factor from the range 4 fit because $T_r = 0.7$ fell outside range 2.

In the case of KE0601, due to limited data, the last selected data point (besides the critical point) fell 1.35 K short of $T_r = 0.7$, and for that compound the acentric factor was calculated from a correlation equation which was extrapolated by that amount. This was the only one of the 14 acentric factors whose calculation involved an extrapolation of the vapor pressure data.

5.1.6. Dipole Moment

The number of literature articles reporting dipole moments is large. Most of that literature was retrieved for the data evaluation program because dipole moment data usually involve binary density data. Unfortunately, the processing and evaluation of the dipole moment data is beyond the scope of our evaluation effort, and no attempt was made to process the literature dipole moment data.

The dipole moment is an important property for physical property correlations, e.g., correlations for the second virial coefficient. As a convenience for the users of this report, dipole moment values from McClellan [5266] have been included in Table 7. When McClellan listed a recommended value for a compound, that value was used. When no recommended value was listed, the values in Table 7 were obtained by taking an arithmetic average of the literature values for solvent measurements listed by McClellan. Any values listed for the pure gas or pure liquid were excluded from the averaging.

5.1.7. Radius of Gyration

Like the dipole moment, the radius of gyration is often used in physical property correlations. As a convenience to the user, values from Thompson [1706] are listed in Table 7. No attempt was made to check or extend the Thompson values.

5.2. Vapor Pressure

The vapor pressure correlation constants for the range 1, 2, 3 and 4 fits are listed in tables 9, 10, 11 and 12 respectively. There are two lines for each correlation, and the compound's identification number appears at the beginning of each line.

The first item following the identification number on the first line for each compound is a single letter--from A through K--which characterizes the quality of the experimental data base for the correlation. Before discussing the vapor pressure correlations in tables 9 through 12, it is necessary to define the quality ratings and give the reader some insight as to how they have been used for both the vapor pressure and liquid density correlations.

Table 9. Range 1 vapor pressure correlations

```
KE0300  A 102  WAGNER**  -0.74974490D 01   0.13173750D 01  -0.26754153D 01
KE0300  -0.26773997D 01   0.50809985D 03   0.46999960D 01  247  509  0.10D 01
KE0305  I  12  RPM2****   0.51708912D 02  -0.74019867D 04  -0.11732730D 00
KE0305   0.12983094D-03                                    238  294  0.18D-01
KE0360  I   4  RPM2****   0.63297187D 02  -0.10289174D 05  -0.13078063D 00
KE0360   0.12264536D-03                                    303  392  0.46D-03
KE0361  I   4  RPM2****   0.26169771D 02  -0.55232119D 04  -0.28809006D-01
KE0361   0.24994206D-04                                    292  392  0.38D-03
KE0362  J   5  RPM2****   0.43814304D 01  -0.42660432D 04   0.37510628D-01
KE0362  -0.34712350D-04                                    348  446  0.33D-01
KE0370  I  17  RIEDEL**   0.52021099D 02  -0.55057334D 01  -0.46044849D 04
KE0370   0.60184321D-16                                    232  411  0.72D 00
KE0380  G  35  WAGNER**  -0.76569653D 01   0.12828020D 01  -0.39738249D 01
KE0380  -0.72826939D 01   0.35724463D 03   0.28411484D 01  194  358  0.29D 01
KE0400  A  65  WAGNER**  -0.76980638D 01   0.16857248D 01  -0.35946384D 01
KE0400  -0.14844025D 01   0.53677979D 03   0.42069960D 01  265  537  0.33D 01
KE0410  J   9  RPM2****  -0.36104822D 02   0.79123257D 03   0.17481982D 00
KE0410  -0.18881169D-03                                    260  363  0.33D 00
KE0420  H  16  RPM2****   0.19664233D 02  -0.49770013D 04  -0.31815092D-02
KE0420  -0.34876835D-05                                    249  381  0.84D-01
KE0430  K   2  RPM2****   0.16936190D 02  -0.49228300D 04   0.00000000D 00
KE0430   0.00000000D 00                                    343  400
KE0440  J   6  RPM2****  -0.25859342D 03   0.25691015D 05   0.84404370D 00
KE0440  -0.86319912D-03                                    300  355  0.64D 00
KE0445  J  13  RPM2****  -0.37836491D 03   0.46708999D 05   0.10059766D 01
KE0445  -0.85404877D-03                                    372  416  0.85D 00
KE0446  K   2  RPM2****   0.17404000D 02  -0.58193928D 04   0.00000000D 00
KE0446   0.00000000D 00                                    343  456
KE0450  J   9  RPM2****   0.68041358D 02  -0.12469551D 05  -0.12079499D 00
KE0450   0.95103685D-04                                    322  428  0.80D-01
KE0451  J   8  RPM2****   0.11101456D 03  -0.16741801D 05  -0.25145797D 00
KE0451   0.22344785D-03                                    306  410  0.90D-01
KE0460  I  17  RPM2****   0.16738657D 02  -0.46777777D 04  -0.33828305D-03
KE0460   0.29316526D-06                                    309  391  0.18D-03
KE0500  E  37  WAGNER**  -0.73516670D 01   0.58891876D 00  -0.21522346D 01
KE0500  -0.58445133D 01   0.56107983D 03   0.36939983D 01  282  545  0.26D 01
KE0501  E  40  WAGNER**  -0.70827199D 01   0.21564015D 00  -0.25715917D 01
KE0501  -0.24178698D 01   0.56145996D 03   0.37289982D 01  282  545  0.37D 01
KE0505  E  34  WAGNER**  -0.72049532D 01   0.35067807D 00  -0.13709136D 01
KE0505  -0.75396462D 01   0.55339990D 03   0.38499985D 01  276  550  0.45D 01
KE0510  H  29  RPM2****  -0.48963358D 02   0.24378665D 04   0.19501662D 00
KE0510  -0.19254584D-03                                    289  412  0.17D 00
KE0520  I  28  VAPRES-2   0.24376810D 03  -0.11456854D 05   0.75261551D-01
KE0520  -0.24333219D-04  -0.39526822D 02                   273  539  0.12D 01
KE0530  J   6  RPM2****   0.16466401D 02  -0.45368554D 04  -0.35654411D-03
KE0530  0.31524389D-06                                     355  380  0.00D 00
KE0540  J   5  RPM2****  -0.11112349D 03   0.10130898D 05   0.37424566D 00
KE0540  -0.36622482D-03                                    311  371  0.16D 00
KE0555  I  13  RPM2****   0.17581976D 02  -0.54557925D 04  -0.54307219D-03
KE0555   0.48989525D-06                                    272  333  0.11D-04
```

Table 9. Range 1 vapor pressure correlations--Continued

KE0563	I 5 RPM2****	-0.36593305D 02	0.11972196D 04	0.13428023D 00
KE0563	-0.10980973D-03			382 463 0.77D-02
KE0565	I 14 RPM2****	0.20595620D 02	-0.56476721D 04	-0.66797188D-02
KE0565	0.21173870D-05			317 419 0.18D 00
KE0566	I 8 RPM2****	0.41970324D 02	-0.99808633D 04	-0.52226934D-01
KE0566	0.39833865D-04			317 459 0.85D-01
KE0570	I 11 RPM2****	0.31404936D 02	-0.87815700D 04	-0.32014182D-01
KE0570	0.34129310D-04			277 333 0.13D-04
KE0600	C 32 WAGNER**	-0.81315482D 01	0.18766746D 01	-0.42287461D 01
KE0600	-0.27338595D 01	0.58700000D 03	0.33229990D 01	298 428 0.38D-02
KE0601	C 24 WAGNER**	-0.79647906D 01	0.17198839D 01	-0.42568912D 01
KE0601	-0.23051546D 01	0.58281982D 03	0.33199987D 01	298 407 0.35D-02
KE0604	H 29 RIEDEL**	0.60863450D 02	-0.64833400D 01	-0.68459575D 04
KE0604	0.10731339D-16			283 567 0.18D 01
KE0605	J 12 RPM2****	0.67406874D 02	-0.11369426D 05	-0.12515635D 00
KE0605	0.10012928D-03			300 389 0.52D 00
KE0607	C 38 WAGNER**	-0.76569055D 01	0.16102765D 01	-0.36188184D 01
KE0607	-0.28748554D 01	0.56700000D 03	0.34699984D 01	284 406 0.71D-02
KE0620	H 32 WAGNER**	-0.82635171D 01	0.91380629D 00	-0.57455934D-01
KE0620	-0.10049146D 02	0.62900000D 03	0.38499985D 01	302 582 0.63D 01
KE0640	I 13 RPM2****	0.12562638D 02	-0.42869180D 04	0.11158413D-01
KE0640	-0.10948396D-04			401 561 0.15D 01
KE0645	I 4 RPM2****	0.41406877D 02	-0.79886545D 04	-0.61649738D-01
KE0645	0.49977846D-04			273 395 0.49D-03
KE0650	J 13 RPM2****	0.40684782D 01	-0.37767853D 04	0.45759886D-01
KE0650	-0.52451646D-04			287 404 0.13D 00
KE0660	J 8 RIEDEL**	0.46007514D 04	-0.67240180D 03	-0.23440132D 06
KE0660	0.41021702D-14			392 402 0.25D-01
KE0670	H 15 RPM2****	0.21864140D 02	-0.64159922D 04	-0.77320691D-02
KE0670	0.36538030D-05			310 442 0.21D-02
KE0680	I 4 RPM2****	-0.53089226D 02	0.31022259D 04	0.17381281D 00
KE0680	-0.14074304D-03			377 488 0.20D-02
KE0700	F 46 WAGNER**	-0.99483801D 01	0.47053877D 01	-0.67889499D 01
KE0700	-0.17144393D 00	0.61150000D 03	0.34359989D 01	274 453 0.60D-01
KE0702	I 7 RPM2****	0.12619969D 02	-0.44925265D 04	0.11623943D-01
KE0702	-0.11975873D-04			273 418 0.13D-01
KE0710	I 11 RPM2****	0.16894049D 02	-0.49772008D 04	-0.12070011D-03
KE0710	0.99568801D-07			349 451 0.66D-03
KE0720	H 15 VAPRES-2	0.47099357D 03	-0.15989232D 05	0.19827006D 00
KE0720	-0.79336319D-04	-0.82270805D 02		293 441 0.26D-01
KE0740	I 22 RPM2****	0.30238353D 02	-0.75018223D 04	-0.28252855D-01
KE0740	0.18152509D-04			313 465 0.31D-01
KE0800	I 12 RPM2****	-0.58281733D 02	0.46022852D 04	0.19032262D 00
KE0800	-0.16244189D-03			293 447 0.13D 00
KE0801	I 11 RPM2****	-0.16377240D 02	-0.14125767D 04	0.91139663D-01
KE0801	-0.82220634D-04			293 441 0.13D 00
KE0802	J 12 RPM2****	0.51574275D 02	-0.86523422D 04	-0.10643159D 00
KE0802	0.10186297D-03			288 424 0.19D 00
KE0810	I 11 RPM2****	0.16856127D 02	-0.52338853D 04	-0.88892330D-04
KE0810	0.75498105D-07			380 481 0.64D-03
KE0830	J 11 RPM2****	0.16867186D 02	-0.51189412D 04	-0.88156709D-04
KE0830	0.73679066D-07			359 461 0.45D-03

Table 9. Range 1 vapor pressure correlations--Continued

KE0850	I	8	RPM2****	0.33729517D 02	-0.82632914D 04	-0.30963951D-01
KE0850	0.22649922D-04				287 409 0.59D-01
KE0870	I	11	RPM2****	0.17090378D 02	-0.55896563D 04	-0.45415371D-03
KE0870	0.39330977D-06				279 381 0.21D-04
KE0890	I	13	RPM2****	0.22435782D 02	-0.67642090D 04	-0.84645315D-02
KE0890	0.20066396D-05				394 485 0.39D-01
KE0910	I	4	RIEDEL**	0.23473348D 04	-0.34498341D 03	-0.11554548D 06
KE0910	0.25357439D-14				332 457 0.76D-05
KE0950	G	58	VAPRES-2	-0.26240368D 04	0.50707528D 05	-0.13624744D 01
KE0950	0.60820529D-03			0.49191888D 03	303 476 0.16D 00
KE0980	J	7	RPM2****	0.63746621D 02	-0.13829575D 05	-0.95899972D-01
KE0980	0.64946645D-04				415 511 0.42D-01
KE1000	I	23	VAPRES-2	0.25066182D 04	-0.66711165D 05	0.11440382D 01
KE1000	-0.48792265D-03			-0.45344764D 03	333 469 0.35D-01
KE1003	C	31	WAGNER**	-0.86650883D 01	0.18886549D 01	-0.55050132D 01
KE1003	-0.29487241D 01			0.64000000D 03	0.23199987D 01	298 486 0.79D-02
KE1020	I	13	VAPRES-2	0.40176615D 03	-0.17039623D 05	0.12875484D 00
KE1020	-0.44344156D-04			-0.66788250D 02	333 454 0.10D-02
KE1060	I	11	RPM2****	0.17107479D 02	-0.58037434D 04	-0.41235569D-03
KE1060	0.35515840D-06				299 401 0.34D-04
KE1100	I	18	RPM2****	0.42065341D 02	-0.96075335D 04	-0.56094570D-01
KE1100	0.39838002D-04				333 494 0.73D-03
KE1180	I	7	RPM2****	-0.31931183D 02	0.76175152D 03	0.11630691D 00
KE1180	-0.91697854D-04				405 491 0.56D-01
KE1200	I	17	RPM2****	0.17973910D 02	-0.63745665D 04	-0.17194104D-02
KE1200	0.12669434D-05				369 521 0.85D-02
KE1500	I	15	RPM2****	0.44285192D 02	-0.10504622D 05	-0.57468922D-01
KE1500	0.39224351D-04				353 424 0.20D-03
KE1600	I	16	RPM2****	0.16332197D 02	-0.54509453D 04	-0.94791231D-04
KE1600	0.79497020D-07				369 521 0.66D-03
KE1620	H	21	RPM2****	-0.73204088D 02	0.90466559D 04	0.18287068D 00
KE1620	-0.12508377D-03				451 500 0.33D 00
KE1700	I	16	RPM2****	0.17009724D 02	-0.62063641D 04	-0.10441452D-03
KE1700	0.87991144D-07				369 521 0.32D-03
KE1720	I	20	RPM2****	0.99367506D 02	-0.19759721D 05	-0.17211686D 00
KE1720	0.11966357D-03				375 535 0.44D-02
KE1800	K	2	RPM2****	0.15630510D 02	-0.58530705D 04	0.00000000D 00
KE1800	0.00000000D 00				395 403
KE1820	J	11	RPM2****	0.25265859D 02	-0.47381032D 04	-0.49092128D-01
KE1820	0.47445496D-04				292 417 0.26D-01
KE1821	J	8	RPM2****	-0.83424914D 02	0.52538877D 04	0.31324636D 00
KE1821	-0.33243093D-03				294 368 0.30D-01
KE1900	J	5	RPM2****	-0.99897398D 02	0.12670804D 05	0.23088809D 00
KE1900	-0.14890088D-03				323 418 0.13D-01
KE1901	J	8	RPM2****	0.66819317D 04	-0.92881114D 06	-0.16059749D 02
KE1901	0.12896429D-01				388 431 0.26D-01
KE2100	F	35	RPM2****	0.39808738D 02	-0.10382444D 05	-0.40885275D-01
KE2100	0.23468422D-04				298 539 0.36D-01
KE2104	C	32	VAPRES-2	0.38789128D 03	-0.19284923D 05	0.10027672D 00
KE2104	-0.29008985D-04			-0.62369530D 02	298 532 0.12D-01
KE2120	I	7	RPM2****	-0.43389210D 02	0.30307622D 04	0.12861987D 00
KE2120	-0.92236652D-04				449 501 0.10D-01

Table 9. Range 1 vapor pressure correlations--Continued

KE2225	I 23 VAPRES-2	-0.30334436D 03	-0.12188523D 03	-0.14965503D 00
KE2225	0.56469159D-04	0.59179741D 02		408 564 0.18D-01
KE2261	K 2 RPM2****	0.19418350D 02	-0.84826264D 04	0.00000000D 00
KE2261	0.00000000D 00			417 574
KE2300	F 19 VAPRES-2	-0.62855974D 03	0.57720465D 04	-0.31642310D 00
KE2300	0.12610738D-03	0.12024952D 03		333 542 0.53D-01
KE2330	J 10 RPM2****	0.44650283D 02	-0.11158370D 05	-0.57059059D-01
KE2330	0.40726555D-04			286 524 0.10D-01
KE2331	J 10 RPM2****	-0.19575553D 04	0.19631481D 06	0.63736451D 01
KE2331	-0.68379550D-02			291 330 0.25D-03
KE2365	G 45 VAPRES-2	-0.73382832D 03	0.11307120D 05	-0.29425735D 00
KE2365	0.10027145D-03	0.13451238D 03		329 622 0.30D 00
KE2460	J 26 RIEDEL**	0.36652016D 03	-0.48575010D 02	-0.32112042D 05
KE2460	0.28048558D-16			558 651 0.31D 00
KE2473	J 7 RPM2****	-0.22362756D 01	-0.64738203D 04	0.43962829D-01
KE2473	-0.30566467D-04			474 724 0.38D-01
KE2474	J 22 RPM2****	0.18832730D 03	-0.38592193D 05	-0.36089778D 00
KE2474	0.26967276D-03			410 496 0.10D-02
KE2477	J 20 RPM2****	-0.35975370D 00	-0.10541719D 05	0.76920902D-01
KE2477	-0.68264351D-04			373 457 0.51D-03
KE2506	C 16 RPM2****	0.50594333D 02	-0.13634600D 05	-0.56890913D-01
KE2506	0.32071991D-04			437 601 0.51D 00
KE2545	I 39 RIEDEL**	0.73424260D 02	-0.76018739D 01	-0.12094587D 05
KE2545	-0.21751014D-17			503 604 0.15D 00
KE2775	J 9 RPM2****	0.54175963D 03	-0.10033771D 06	-0.10049879D 01
KE2775	0.63820178D-03			456 549 0.12D-01
KE3350	K 2 RPM2****	0.28106180D 02	-0.14368583D 05	0.00000000D 00
KE3350	0.00000000D 00			443 525

Table 10. Range 2 vapor pressure correlations

```
KE0300  A  79  WAGNER**  -0.75475020D 01   0.14452612D 01  -0.29036443D 01
KE0300  -0.21275823D 01   0.50809985D 03   0.46999960D 01  247  348  0.28D-01
KE0305  I  12  RPM2****   0.51708912D 02  -0.74019867D 04  -0.11732730D 00
KE0305   0.12983094D-03                                     238  294  0.18D-01
KE0360  I   4  RPM2****   0.63297187D 02  -0.10289174D 05  -0.13078063D 00
KE0360   0.12264536D-03                                     303  392  0.46D-03
KE0361  I   4  RPM2****   0.26169771D 02  -0.55232119D 04  -0.28809006D-01
KE0361   0.24994206D-04                                     292  392  0.38D-03
KE0362  J   5  RPM2****   0.43814304D 01  -0.42660432D 04   0.37510628D-01
KE0362  -0.34712350D-04                                     348  446  0.33D-01
KE0370  I   7  RIEDEL**   0.51924067D 02  -0.54678495D 01  -0.46277611D 04
KE0370  -0.94190148D-17                                     232  287  0.99D-01
KE0380  G  15  WAGNER**  -0.68017611D 01  -0.90258908D 00   0.74037148D-01
KE0380  -0.18709122D 02   0.35724463D 03   0.28411484D 01  194  265  0.21D 00
KE0400  A  39  WAGNER**  -0.80361159D 01   0.24595576D 01  -0.46452494D 01
KE0400   0.20832996D 00   0.53677979D 03   0.42069960D 01  265  371  0.53D-01
KE0410  J   9  RPM2****  -0.36104822D 02   0.79123257D 03   0.17481982D 00
KE0410  -0.18881169D-03                                     260  363  0.33D 00
KE0420  H  16  RPM2****   0.19664233D 02  -0.49770013D 04  -0.31815092D-02
KE0420  -0.34876835D-05                                     249  381  0.84D-01
KE0430  K   2  RPM2****   0.16936190D 02  -0.49228300D 04   0.00000000D 00
KE0430   0.00000000D 00                                     343  400
KE0440  J   6  RPM2****  -0.25859342D 03   0.25691015D 05   0.84404370D 00
KE0440  -0.86319912D-03                                     300  355  0.64D 00
KE0445  J  13  RPM2****  -0.37836491D 03   0.46708999D 05   0.10059766D 01
KE0445  -0.85404877D-03                                     372  416  0.85D 00
KE0446  K   2  RPM2****   0.17404000D 02  -0.58193928D 04   0.00000000D 00
KE0446   0.00000000D 00                                     343  456
KE0450  J   9  RPM2****   0.68041358D 02  -0.12469551D 05  -0.12079499D 00
KE0450   0.95103685D-04                                     322  428  0.80D-01
KE0451  J   8  RPM2****   0.11101456D 03  -0.16741801D 05  -0.25145797D 00
KE0451   0.22344785D-03                                     306  410  0.90D-01
KE0460  I  17  RPM2****   0.16738657D 02  -0.46777777D 04  -0.33828305D-03
KE0460   0.29316526D-06                                     309  391  0.18D-03
KE0500  A  25  WAGNER**  -0.76517516D 01   0.13209503D 01  -0.33462984D 01
KE0500  -0.32001583D 01   0.56107983D 03   0.36939983D 01  282  395  0.29D-01
KE0501  A  24  WAGNER**  -0.77760626D 01   0.17033533D 01  -0.41525350D 01
KE0501  -0.13722948D 01   0.56145996D 03   0.37289982D 01  282  385  0.35D-02
KE0505  B  25  WAGNER**  -0.79425250D 01   0.20530981D 01  -0.37421557D 01
KE0505  -0.34919809D 01   0.55339990D 03   0.38499985D 01  276  377  0.10D-01
KE0510  H  29  RPM2****  -0.48963358D 02   0.24378665D 04   0.19501662D 00
KE0510  -0.19254584D-03                                     289  412  0.17D 00
KE0520  I  17  VAPRES-2   0.56206527D 03  -0.18068105D 05   0.25540648D 00
KE0520  -0.11377508D-03  -0.99531428D 02                    273  416  0.31D-01
KE0530  J   6  RPM2****   0.16466401D 02  -0.45368554D 04  -0.35654411D-03
KE0530  0.31524389D-06                                      355  380  0.00D 00
KE0540  J   5  RPM2****  -0.11112349D 03   0.10130898D 05   0.37424566D 00
KE0540  -0.36622482D-03                                     311  371  0.16D 00
KE0555  I  13  RPM2****   0.17581976D 02  -0.54557925D 04  -0.54307219D-03
KE0555   0.48989525D-06                                     272  333  0.11D-04
KE0563  I   5  RPM2****  -0.36593305D 02   0.11972196D 04   0.13428023D 00
KE0563  -0.10980973D-03                                     382  463  0.77D-02
```

Table 10. Range 2 vapor pressure correlations--Continued

KE0565	I 14 RPM2****	0.20595620D 02	-0.56476721D 04	-0.66797188D-02
KE0565	0.21173870D-05			317 419 0.18D 00
KE0566	I 8 RPM2****	0.41970324D 02	-0.99808633D 04	-0.52226934D-01
KE0566	0.39833865D-04			317 459 0.85D-01
KE0570	I 11 RPM2****	0.31404936D 02	-0.87815700D 04	-0.32014182D-01
KE0570	0.34129310D-04			277 333 0.13D-04
KE0600	C 30 WAGNER**	-0.81216982D 01	0.18535284D 01	-0.41948020D 01
KE0600	-0.27979991D 01	0.58700000D 03	0.33229990D 01	298 417 0.29D-02
KE0601	C 24 WAGNER**	-0.79647906D 01	0.17198839D 01	-0.42568912D 01
KE0601	-0.23051546D 01	0.58281982D 03	0.33199987D 01	298 407 0.35D-02
KE0604	H 11 WAGNER**	-0.54683310D 01	-0.42671786D 01	0.52946853D 01
KE0604	-0.22805945D 02	0.57100000D 03	0.32699986D 01	283 389 0.84D-01
KE0605	J 12 RPM2****	0.67406874D 02	-0.11369426D 05	-0.12515635D 00
KE0605	0.10012928D-03			300 389 0.52D 00
KE0607	C 36 WAGNER**	-0.76403269D 01	0.15718952D 01	-0.35647812D 01
KE0607	-0.29702606D 01	0.56700000D 03	0.34699984D 01	284 395 0.68D-02
KE0620	H 23 WAGNER**	-0.10550075D 02	0.62701309D 01	-0.77788104D 01
KE0620	0.36400539D 01	0.62900000D 03	0.38499985D 01	302 434 0.67D-01
KE0645	I 4 RPM2****	0.41406877D 02	-0.79886545D 04	-0.61649738D-01
KE0645	0.49977846D-04			273 395 0.49D-03
KE0650	J 13 RPM2****	0.40684782D 01	-0.37767853D 04	0.45759886D-01
KE0650	-0.52451646D-04			287 404 0.13D 00
KE0660	J 8 RIEDEL**	0.46007514D 04	-0.67240180D 03	-0.23440132D 06
KE0660	0.41021702D-14			392 402 0.25D-01
KE0670	H 15 RPM2****	0.21864140D 02	-0.64159922D 04	-0.77320691D-02
KE0670	0.36538030D-05			310 442 0.21D-02
KE0680	I 4 RPM2****	-0.53089226D 02	0.31022259D 04	0.17381281D 00
KE0680	-0.14074304D-03			377 488 0.20D-02
KE0700	F 44 WAGNER**	-0.98709446D 01	0.45299059D 01	-0.65596530D 01
KE0700	-0.50714254D 00	0.61150000D 03	0.34359989D 01	274 442 0.39D-01
KE0702	I 7 RPM2****	0.12619969D 02	-0.44925265D 04	0.11623943D-01
KE0702	-0.11975873D-04			273 418 0.13D-01
KE0710	I 8 RPM2****	0.16968053D 02	-0.49868283D 04	-0.30987682D-03
KE0710	0.26042134D-06			349 421 0.36D-03
KE0720	H 12 RPM2****	0.31024959D 02	-0.65104600D 04	-0.38616077D-01
KE0720	0.33808294D-04			293 411 0.30D-01
KE0740	I 22 RPM2****	0.30238353D 02	-0.75018223D 04	-0.28252855D-01
KE0740	0.18152509D-04			313 465 0.31D-01
KE0800	I 12 RPM2****	-0.58281733D 02	0.46022852D 04	0.19032262D 00
KE0800	-0.16244189D-03			293 447 0.13D 00
KE0801	I 11 RPM2****	-0.16377240D 02	-0.14125767D 04	0.91139663D-01
KE0801	-0.82220634D-04			293 441 0.13D 00
KE0802	J 12 RPM2****	0.51574275D 02	-0.86523422D 04	-0.10643159D 00
KE0802	0.10186297D-03			288 424 0.19D 00
KE0810	I 11 RPM2****	0.16856127D 02	-0.52338853D 04	-0.88892330D-04
KE0810	0.75498105D-07			380 481 0.64D-03
KE0830	I 11 RPM2****	0.16867186D 02	-0.51189412D 04	-0.88156709D-04
KE0830	0.73679066D-07			359 461 0.45D-03
KE0850	I 8 RPM2****	0.33729517D 02	-0.82632914D 04	-0.30963951D-01
KE0850	0.22649922D-04			287 409 0.59D-01
KE0870	I 11 RPM2****	0.17090378D 02	-0.55896563D 04	-0.45415371D-03
KE0870	0.39330977D-06			279 381 0.21D-04

Table 10. Range 2 vapor pressure correlations--Continued

KE0890	I	13	RPM2****	0.22435782D 02	-0.67642090D 04	-0.84645315D-02
KE0890	0.20066396D-05				394 485 0.39D-01
KE0910	I	4	RIEDEL**	0.23473348D 04	-0.34498341D 03	-0.11554548D 06
KE0910	0.25357439D-14				332 457 0.76D-05
KE0950	G	58	VAPRES-2	-0.26240368D 04	0.50707528D 05	-0.13624744D 01
KE0950	0.60820529D-03			0.49191888D 03	303 476 0.16D 00
KE0980	J	7	RPM2****	0.63746621D 02	-0.13829575D 05	-0.95899972D-01
KE0980	0.64946645D-04				415 511 0.42D-01
KE1000	I	23	VAPRES-2	0.25066182D 04	-0.66711165D 05	0.11440382D 01
KE1000	-0.48792265D-03			-0.45344764D 03	333 469 0.35D-01
KE1003	C	30	WAGNER**	-0.86610867D 01	0.18792310D 01	-0.54913237D 01
KE1003	-0.29722768D 01			0.64000000D 03	0.23199987D 01	298 480 0.74D-02
KE1020	I	13	VAPRES-2	0.40176615D 03	-0.17039623D 05	0.12875484D 00
KE1020	-0.44344156D-04			-0.66788250D 02	333 454 0.10D-02
KE1060	I	11	RPM2****	0.17107479D 02	-0.58037434D 04	-0.41235569D-03
KE1060	0.35515840D-06				299 401 0.34D-04
KE1100	I	18	RPM2****	0.42065341D 02	-0.96075335D 04	-0.56094570D-01
KE1100	0.39838002D-04				333 494 0.73D-03
KE1180	I	7	RPM2****	-0.31931183D 02	0.76175152D 03	0.11630691D 00
KE1180	-0.91697854D-04				405 491 0.56D-01
KE1200	I	16	RPM2****	0.18114459D 02	-0.63943280D 04	-0.20508118D-02
KE1200	0.15259788D-05				369 511 0.70D-02
KE1500	I	15	RPM2****	0.44285192D 02	-0.10504622D 05	-0.57468922D-01
KE1500	0.39224351D-04				353 424 0.20D-03
KE1600	I	12	RPM2****	0.16348405D 02	-0.54532192D 04	-0.13314052D-03
KE1600	0.10961990D-06				369 481 0.17D-03
KE1620	H	21	RPM2****	-0.73204088D 02	0.90466559D 04	0.18287068D 00
KE1620	-0.12508377D-03				451 500 0.33D 00
KE1700	I	16	RPM2****	0.17009724D 02	-0.62063641D 04	-0.10441452D-03
KE1700	0.87991144D-07				369 521 0.32D-03
KE1720	I	20	RPM2****	0.99367506D 02	-0.19759721D 05	-0.17211686D 00
KE1720	0.11966357D-03				375 535 0.44D-02
KE1800	K	2	RPM2****	0.15630510D 02	-0.58530705D 04	0.00000000D 00
KE1800	0.00000000D 00				395 403
KE1820	J	11	RPM2****	0.25265859D 02	-0.47381032D 04	-0.49092128D-01
KE1820	0.47445496D-04				292 417 0.26D-01
KE1821	J	8	RPM2****	-0.83424914D 02	0.52538877D 04	0.31324636D 00
KE1821	-0.33243093D-03				294 368 0.30D-01
KE1900	J	5	RPM2****	-0.99897398D 02	0.12670804D 05	0.23088809D 00
KE1900	-0.14890088D-03				323 418 0.13D-01
KE1901	J	8	RPM2****	0.66819317D 04	-0.92881114D 06	-0.16059749D 02
KE1901	0.12896429D-01				388 431 0.26D-01
KE2100	F	33	RPM2****	0.39858830D 02	-0.10388870D 05	-0.41013400D-01
KE2100	0.23576007D-04				298 527 0.28D-01
KE2104	C	30	VAPRES-2	0.40188328D 03	-0.19622726D 05	0.10659951D 00
KE2104	-0.31594792D-04			-0.64916970D 02	298 521 0.13D-01
KE2120	I	7	RPM2****	-0.43389210D 02	0.30307622D 04	0.12861987D 00
KE2120	-0.92236652D-04				449 501 0.10D-01
KE2225	I	22	VAPRES-2	-0.35752726D 03	0.13802298D 04	-0.16995624D 00
KE2225	0.63613684D-04			0.68760896D 02	408 556 0.16D-01
KE2261	K	2	RPM2****	0.19418350D 02	-0.84826264D 04	0.00000000D 00
KE2261	0.00000000D 00				417 574

Table 10. Range 2 vapor pressure correlations--Continued

KE2300	F 19 VAPRES-2	-0.62855974D 03	0.57720465D 04	-0.31642310D 00
KE2300	0.12610738D-03	0.12024952D 03		333 542 0.53D-01
KE2330	J 10 RPM2****	0.44650283D 02	-0.11158370D 05	-0.57059059D-01
KE2330	0.40726555D-04			286 524 0.10D-01
KE2331	J 10 RPM2****	-0.19575553D 04	0.19631481D 06	0.63736451D 01
KE2331	-0.68379550D-02			291 330 0.25D-03
KE2365	G 41 VAPRES-2	-0.99581025D 03	0.18157724D 05	-0.39969474D 00
KE2365	0.13929486D-03	0.18137657D 03		329 598 0.20D 00
KE2460	J 26 RIEDEL**	0.36652016D 03	-0.48575010D 02	-0.32112042D 05
KE2460	0.28048558D-16			558 651 0.31D 00
KE2473	J 7 RPM2****	-0.22362756D 01	-0.64738203D 04	0.43962829D-01
KE2473	-0.30566467D-04			474 724 0.38D-01
KE2474	J 22 RPM2****	0.18832730D 03	-0.38592193D 05	-0.36089778D 00
KE2474	0.26967276D-03			410 496 0.10D-02
KE2477	J 20 RPM2****	-0.35975370D 00	-0.10541719D 05	0.76920902D-01
KE2477	-0.68264351D-04			373 457 0.51D-03
KE2506	C 14 RPM2****	0.39391556D 02	-0.11775235D 05	-0.34494615D-01
KE2506	0.17216390D-04			437 576 0.22D 00
KE2545	I 39 RIEDEL**	0.73424260D 02	-0.76018739D 01	-0.12094587D 05
KE2545	-0.21751014D-17			503 604 0.15D 00
KE2775	J 9 RPM2****	0.54175963D 03	-0.10033771D 06	-0.10049879D 01
KE2775	0.63820178D-03			456 549 0.12D-01
KE3350	K 2 RPM2****	0.28106180D 02	-0.14368583D 05	0.00000000D 00
KE3350	0.00000000D 00			443 525

Table 11. Range 3 vapor pressure correlations

```
KE0300  A  93  WAGNER**  -0.76478446D 01   0.16786170D 01  -0.32366434D 01
KE0300  -0.15276237D 01   0.50809985D 03   0.46999960D 01  247  398  0.96D-01
KE0305  I  12  RPM2****   0.51708912D 02  -0.74019867D 04  -0.11732730D 00
KE0305   0.12983094D-03                                    238  294  0.18D-01
KE0360  I   4  RPM2****   0.63297187D 02  -0.10289174D 05  -0.13078063D 00
KE0360   0.12264536D-03                                    303  392  0.46D-03
KE0361  I   4  RPM2****   0.26169771D 02  -0.55232119D 04  -0.28809006D-01
KE0361   0.24994206D-04                                    292  392  0.38D-03
KE0362  J   5  RPM2****   0.43814304D 01  -0.42660432D 04   0.37510628D-01
KE0362  -0.34712350D-04                                    348  446  0.33D-01
KE0370  I  11  VAPRES-2    0.48887711D 03  -0.12792830D 05   0.28424310D 00
KE0370  -0.15548657D-03  -0.89800244D 02                   232  345  0.35D 00
KE0380  G  22  WAGNER**  -0.74864472D 01   0.82054154D 00  -0.29970338D 01
KE0380  -0.10487798D 02   0.35724463D 03   0.28411484D 01  194  304  0.12D 01
KE0400  A  49  WAGNER**  -0.76396468D 01   0.15330646D 01  -0.33071878D 01
KE0400  -0.22181141D 01   0.53677979D 03   0.42069960D 01  265  448  0.18D 00
KE0410  J   9  RPM2****  -0.36104822D 02   0.79123257D 03   0.17481982D 00
KE0410  -0.18881169D-03                                    260  363  0.33D 00
KE0420  H  16  RPM2****   0.19664233D 02  -0.49770013D 04  -0.31815092D-02
KE0420  -0.34876835D-05                                    249  381  0.84D-01
KE0430  K   2  RPM2****   0.16936190D 02  -0.49228300D 04   0.00000000D 00
KE0430   0.00000000D 00                                    343  400
KE0440  J   6  RPM2****  -0.25859342D 03   0.25691015D 05   0.84404370D 00
KE0440  -0.86319912D-03                                    300  355  0.64D 00
KE0445  J  13  RPM2****  -0.37836491D 03   0.46708999D 05   0.10059766D 01
KE0445  -0.85404877D-03                                    372  416  0.85D 00
KE0446  K   2  RPM2****   0.17404000D 02  -0.58193928D 04   0.00000000D 00
KE0446   0.00000000D 00                                    343  456
KE0450  J   9  RPM2****   0.68041358D 02  -0.12469551D 05  -0.12079499D 00
KE0450   0.95103685D-04                                    322  428  0.80D-01
KE0451  J   8  RPM2****   0.11101456D 03  -0.16741801D 05  -0.25145797D 00
KE0451   0.22344785D-03                                    306  410  0.90D-01
KE0460  I  17  RPM2****   0.16738657D 02  -0.46777777D 04  -0.33828305D-03
KE0460   0.29316526D-06                                    309  391  0.18D-03
KE0500  E  27  WAGNER**  -0.75098802D 01   0.98487982D 00  -0.28407473D 01
KE0500  -0.41918431D 01   0.56107983D 03   0.36939983D 01  282  473  0.28D 00
KE0501  E  29  WAGNER**  -0.64924142D 01  -0.12998031D 01   0.20895716D 00
KE0501  -0.94551795D 01   0.56145996D 03   0.37289982D 01  282  473  0.12D 01
KE0505  B  25  WAGNER**  -0.79425250D 01   0.20530981D 01  -0.37421557D 01
KE0505  -0.34919809D 01   0.55339990D 03   0.38499985D 01  276  377  0.10D-01
KE0510  H  29  RPM2****  -0.48963358D 02   0.24378665D 04   0.19501662D 00
KE0510  -0.19254584D-03                                    289  412  0.17D 00
KE0520  I  28  VAPRES-2    0.24376810D 03  -0.11456854D 05   0.75261551D-01
KE0520  -0.24333219D-04  -0.39526822D 02                   273  539  0.12D 01
KE0530  J   6  RPM2****   0.16466401D 02  -0.45368554D 04  -0.35654411D-03
KE0530  0.31524389D-06                                     355  380  0.00D 00
KE0540  J   5  RPM2****  -0.11112349D 03   0.10130898D 05   0.37424566D 00
KE0540  -0.36622482D-03                                    311  371  0.16D 00
KE0555  I  13  RPM2****   0.17581976D 02  -0.54557925D 04  -0.54307219D-03
KE0555   0.48989525D-06                                    272  333  0.11D-04
KE0563  I   5  RPM2****  -0.36593305D 02   0.11972196D 04   0.13428023D 00
KE0563  -0.10980973D-03                                    382  463  0.77D-02
```

Table 11. Range 3 vapor pressure correlations-Continued

KE0565	I 14 RPM2****	0.20595620D 02	-0.56476721D 04	-0.66797188D-02
KE0565	0.21173870D-05			317 419 0.18D 00
KE0566	I 8 RPM2****	0.41970324D 02	-0.99808633D 04	-0.52226934D-01
KE0566	0.39833865D-04			317 459 0.85D-01
KE0570	I 11 RPM2****	0.31404936D 02	-0.87815700D 04	-0.32014182D-01
KE0570	0.34129310D-04			277 333 0.13D-04
KE0600	C 32 WAGNER**	-0.81315482D 01	0.18766746D 01	-0.42287461D 01
KE0600	-0.27338595D 01	0.58700000D 03	0.33229990D 01	298 428 0.38D-02
KE0601	C 24 WAGNER**	-0.79647906D 01	0.17198839D 01	-0.42568912D 01
KE0601	-0.23051546D 01	0.58281982D 03	0.33199987D 01	298 407 0.35D-02
KE0604	H 15 WAGNER**	-0.69749525D 01	-0.78241822D 00	0.41328603D 00
KE0604	-0.14350688D 02	0.57100000D 03	0.32699986D 01	283 484 0.13D 01
KE0605	J 12 RPM2****	0.67406874D 02	-0.11369426D 05	-0.12515635D 00
KE0605	0.10012928D-03			300 389 0.52D 00
KE0607	C 38 WAGNER**	-0.76569055D 01	0.16102765D 01	-0.36188184D 01
KE0607	-0.28748554D 01	0.56700000D 03	0.34699984D 01	284 406 0.71D-02
KE0620	H 26 WAGNER**	-0.86065609D 01	0.17456880D 01	-0.13681218D 01
KE0620	-0.74119991D 01	0.62900000D 03	0.38499985D 01	302 533 0.12D 01
KE0640	I 13 RPM2****	0.12562638D 02	-0.42869180D 04	0.11158413D-01
KE0640	-0.10948396D-04			401 561 0.15D 01
KE0645	I 4 RPM2****	0.41406877D 02	-0.79886545D 04	-0.61649738D-01
KE0645	0.49977846D-04			273 395 0.49D-03
KE0650	J 13 RPM2****	0.40684782D 01	-0.37767853D 04	0.45759886D-01
KE0650	-0.52451646D-04			287 404 0.13D 00
KE0660	J 8 RIEDEL**	0.46007514D 04	-0.67240180D 03	-0.23440132D 06
KE0660	0.41021702D-14			392 402 0.25D-01
KE0670	H 15 RPM2****	0.21864140D 02	-0.64159922D 04	-0.77320691D-02
KE0670	0.36538030D-05			310 442 0.21D-02
KE0680	I 4 RPM2****	-0.53089226D 02	0.31022259D 04	0.17381281D 00
KE0680	-0.14074304D-03			377 488 0.20D-02
KE0700	F 46 WAGNER**	-0.99483801D 01	0.47053877D 01	-0.67889499D 01
KE0700	-0.17144393D 00	0.61150000D 03	0.34359989D 01	274 453 0.60D-01
KE0702	I 7 RPM2****	0.12619969D 02	-0.44925265D 04	0.11623943D-01
KE0702	-0.11975873D-04			273 418 0.13D-01
KE0710	I 11 RPM2****	0.16894049D 02	-0.49772008D 04	-0.12070011D-03
KE0710	0.99568801D-07			349 451 0.66D-03
KE0720	H 15 VAPRES-2	0.47099357D 03	-0.15989232D 05	0.19827006D 00
KE0720	-0.79336319D-04	-0.82270805D 02		293 441 0.26D-01
KE0740	I 22 RPM2****	0.30238353D 02	-0.75018223D 04	-0.28252855D-01
KE0740	0.18152509D-04			313 465 0.31D-01
KE0800	I 12 RPM2****	-0.58281733D 02	0.46022852D 04	0.19032262D 00
KE0800	-0.16244189D-03			293 447 0.13D 00
KE0801	I 11 RPM2****	-0.16377240D 02	-0.14125767D 04	0.91139663D-01
KE0801	-0.82220634D-04			293 441 0.13D 00
KE0802	J 12 RPM2****	0.51574275D 02	-0.86523422D 04	-0.10643159D 00
KE0802	0.10186297D-03			288 424 0.19D 00
KE0810	I 11 RPM2****	0.16856127D 02	-0.52338853D 04	-0.88892330D-04
KE0810	0.75498105D-07			380 481 0.64D-03
KE0830	I 11 RPM2****	0.16867186D 02	-0.51189412D 04	-0.88156709D-04
KE0830	0.73679066D-07			359 461 0.45D-03
KE0850	I 8 RPM2****	0.33729517D 02	-0.82632914D 04	-0.30963951D-01
KE0850	0.22649922D-04			287 409 0.59D-01

Table 11. Range 3 vapor pressure correlations--Continued

KE0870	I 11 RPM2****	0.17090378D 02	-0.55896563D 04	-0.45415371D-03
KE0870	0.39330977D-06			279 381 0.21D-04
KE0890	I 13 RPM2****	0.22435782D 02	-0.67642090D 04	-0.84645315D-02
KE0890	0.20066396D-05			394 485 0.39D-01
KE0910	I 4 RIEDEL**	0.23473348D 04	-0.34498341D 03	-0.11554548D 06
KE0910	0.25357439D-14			332 457 0.76D-05
KE0950	G 58 VAPRES-2	-0.26240368D 04	0.50707528D 05	-0.13624744D 01
KE0950	0.60820529D-03	0.49191888D 03		303 476 0.16D 00
KE0980	J 7 RPM2****	0.63746621D 02	-0.13829575D 05	-0.95899972D-01
KE0980	0.64946645D-04			415 511 0.42D-01
KE1000	I 23 VAPRES-2	0.25066182D 04	-0.66711165D 05	0.11440382D 01
KE1000	-0.48792265D-03	-0.45344764D 03		333 469 0.35D-01
KE1003	C 31 WAGNER**	-0.86650883D 01	0.18886549D 01	-0.55050132D 01
KE1003	-0.29487241D 01	0.64000000D 03	0.23199987D 01	298 486 0.79D-02
KE1020	I 13 VAPRES-2	0.40176615D 03	-0.17039623D 05	0.12875484D 00
KE1020	-0.44344156D-04	-0.66788250D 02		333 454 0.10D-02
KE1060	I 11 RPM2****	0.17107479D 02	-0.58037434D 04	-0.41235569D-03
KE1060	0.35515840D-06			299 401 0.34D-04
KE1100	I 18 RPM2****	0.42065341D 02	-0.96075335D 04	-0.56094570D-01
KE1100	0.39838002D-04			333 494 0.73D-03
KE1180	I 7 RPM2****	-0.31931183D 02	0.76175152D 03	0.11630691D 00
KE1180	-0.91697854D-04			405 491 0.56D-01
KE1200	I 17 RPM2****	0.17973910D 02	-0.63745665D 04	-0.17194104D-02
KE1200	0.12669434D-05			369 521 0.85D-02
KE1500	I 15 RPM2****	0.44285192D 02	-0.10504622D 05	-0.57468922D-01
KE1500	0.39224351D-04			353 424 0.20D-03
KE1600	I 16 RPM2****	0.16332197D 02	-0.54509453D 04	-0.94791231D-04
KE1600	0.79497020D-07			369 521 0.66D-03
KE1620	H 21 RPM2****	-0.73204088D 02	0.90466559D 04	0.18287068D 00
KE1620	-0.12508377D-03			451 500 0.33D 00
KE1700	I 16 RPM2****	0.17009724D 02	-0.62063641D 04	-0.10441452D-03
KE1700	0.87991144D-07			369 521 0.32D-03
KE1720	I 20 RPM2****	0.99367506D 02	-0.19759721D 05	-0.17211686D 00
KE1720	0.11966357D-03			375 535 0.44D-02
KE1800	K 2 RPM2****	0.15630510D 02	-0.58530705D 04	0.00000000D 00
KE1800	0.00000000D 00			395 403
KE1820	J 11 RPM2****	0.25265859D 02	-0.47381032D 04	-0.49092128D-01
KE1820	0.47445496D-04			292 417 0.26D-01
KE1821	J 8 RPM2****	-0.83424914D 02	0.52538877D 04	0.31324636D 00
KE1821	-0.33243093D-03			294 368 0.30D-01
KE1900	J 5 RPM2****	-0.99897398D 02	0.12670804D 05	0.23088809D 00
KE1900	-0.14890088D-03			323 418 0.13D-01
KE1901	J 8 RPM2****	0.66819317D 04	-0.92881114D 06	-0.16059749D 02
KE1901	0.12896429D-01			388 431 0.26D-01
KE2100	F 35 RPM2****	0.39808738D 02	-0.10382444D 05	-0.40885275D-01
KE2100	0.23468422D-04			298 539 0.36D-01
KE2104	C 32 VAPRES-2	0.38789128D 03	-0.19284923D 05	0.10027672D 00
KE2104	-0.29008985D-04	-0.62369530D 02		298 532 0.12D-01
KE2120	I 7 RPM2****	-0.43389210D 02	0.30307622D 04	0.12861987D 00
KE2120	-0.92236652D-04			449 501 0.10D-01
KE2225	I 23 VAPRES-2	-0.30334436D 03	-0.12188523D 03	-0.14965503D 00
KE2225	0.56469159D-04	0.59179741D 02		408 564 0.18D-01

Table 11. Range 3 vapor pressure correlations--Continued

```
KE2261  K   2  RPM2****    0.19418350D 02  -0.84826264D 04   0.00000000D 00
KE2261   0.00000000D 00                                     417  574
KE2300  F  19  VAPRES-2   -0.62855974D 03   0.57720465D 04  -0.31642310D 00
KE2300   0.12610738D-03    0.12024952D 03                   333  542  0.53D-01
KE2330  J  10  RPM2****    0.44650283D 02  -0.11158370D 05  -0.57059059D-01
KE2330   0.40726555D-04                                     286  524  0.10D-01
KE2331  J  10  RPM2****   -0.19575553D 04   0.19631481D 06   0.63736451D 01
KE2331  -0.68379550D-02                                     291  330  0.25D-03
KE2365  G  45  VAPRES-2   -0.73382832D 03   0.11307120D 05  -0.29425735D 00
KE2365   0.10027145D-03    0.13451238D 03                   329  622  0.30D 00
KE2460  J  26  RIEDEL**    0.36652016D 03  -0.48575010D 02  -0.32112042D 05
KE2460   0.28048558D-16                                     558  651  0.31D 00
KE2473  J   7  RPM2****   -0.22362756D 01  -0.64738203D 04   0.43962829D-01
KE2473  -0.30566467D-04                                     474  724  0.38D-01
KE2474  J  22  RPM2****    0.18832730D 03  -0.38592193D 05  -0.36089778D 00
KE2474   0.26967276D-03                                     410  496  0.10D-02
KE2477  J  20  RPM2****   -0.35975370D 00  -0.10541719D 05   0.76920902D-01
KE2477  -0.68264351D-04                                     373  457  0.51D-03
KE2506  C  16  RPM2****    0.50594333D 02  -0.13634600D 05  -0.56890913D-01
KE2506   0.32071991D-04                                     437  601  0.51D 00
KE2545  I  39  RIEDEL**    0.73424260D 02  -0.76018739D 01  -0.12094587D 05
KE2545  -0.21751014D-17                                     503  604  0.15D 00
KE2775  J   9  RPM2****    0.54175963D 03  -0.10033771D 06  -0.10049879D 01
KE2775   0.63820178D-03                                     456  549  0.12D-01
KE3350  K   2  RPM2****    0.28106180D 02  -0.14368583D 05   0.00000000D 00
KE3350   0.00000000D 00                                     443  525
```

Table 12. Range 4 vapor pressure correlations

KE0300	A 63 WAGNER**	-0.74271578D 01	0.10922862D 01	-0.19873034D 01
KE0300	-0.65774782D 01	0.50809985D 03	0.46999960D 01	309 509 0.12D 01
KE0370	I 13 RIEDEL**	0.51987333D 02	-0.54992005D 01	-0.46055390D 04
KE0370	0.59499181D-16			273 411 0.76D 00
KE0380	G 29 WAGNER**	-0.77804023D 01	0.17061565D 01	-0.55119078D 01
KE0380	0.36491593D 01	0.35724463D 03	0.28411484D 01	225 358 0.31D 01
KE0400	A 49 WAGNER**	-0.77821606D 01	0.19660930D 01	-0.45547369D 01
KE0400	0.51033664D 01	0.53677979D 03	0.42069960D 01	333 537 0.29D 01
KE0420	H 5 RPM2****	-0.41338309D 02	0.26826805D 04	0.15847068D 00
KE0420	-0.14601138D-03			356 381 0.71D-02
KE0500	E 30 WAGNER**	-0.72551714D 01	0.25769821D 00	-0.10269338D 01
KE0500	-0.12997027D 02	0.56107983D 03	0.36939983D 01	355 545 0.26D 01
KE0501	E 31 WAGNER**	-0.74645307D 01	0.15101506D 01	-0.70957752D 01
KE0501	0.29279142D 02	0.56145996D 03	0.37289982D 01	355 545 0.40D 01
KE0505	E 25 WAGNER**	-0.77016861D 01	0.20979165D 01	-0.74639778D 01
KE0505	0.32055908D 02	0.55339990D 03	0.38499985D 01	350 550 0.19D 01
KE0510	H 6 RIEDEL**	0.33460813D 04	-0.48757859D 03	-0.17259015D 06
KE0510	0.26929717D-14			393 412 0.30D-01
KE0520	I 17 VAPRES-2	0.37597781D 03	-0.14596625D 05	0.13510762D 00
KE0520	-0.48500018D-04	-0.63633082D 02		388 539 0.16D 01
KE0600	C 13 WAGNER**	-0.82250937D 01	0.21242391D 01	-0.47585480D 01
KE0600	-0.41166467D 00	0.58700000D 03	0.33229990D 01	385 428 0.32D-02
KE0601	C 14 WAGNER**	-0.77461734D 01	0.11668065D 01	-0.32275202D 01
KE0601	-0.56463010D 01	0.58281982D 03	0.33199987D 01	379 407 0.20D-02
KE0604	I 19 WAGNER**	-0.77857409D 01	0.11556420D 01	0.14013432D 01
KE0604	-0.12915196D 03	0.57100000D 03	0.32699986D 01	388 567 0.16D 01
KE0607	C 16 WAGNER**	-0.76862355D 01	0.16766059D 01	-0.36938294D 01
KE0607	-0.30089991D 01	0.56700000D 03	0.34699984D 01	362 406 0.87D-02
KE0620	J 18 WAGNER**	-0.77777529D 01	-0.64181523D 00	0.44407638D 01
KE0620	-0.30293267D 02	0.62900000D 03	0.38499985D 01	413 582 0.59D 01
KE0640	I 13 RPM2****	0.12562638D 02	-0.42869180D 04	0.11158413D-01
KE0640	-0.10948396D-04			401 561 0.15D 01
KE0700	C 11 WAGNER**	-0.11049744D 02	0.76039453D 01	-0.12885185D 02
KE0700	0.25715023D 02	0.61150000D 03	0.34359989D 01	407 453 0.12D-01
KE0710	I 7 RPM2****	0.16781712D 02	-0.49615208D 04	0.14711739D-03
KE0710	-0.11291159D-06			390 451 0.71D-03
KE0720	H 7 RIEDEL**	0.16486399D 02	-0.20851789D-01	-0.46599068D 04
KE0720	0.11864683D-18			380 441 0.40D-03
KE0740	I 7 RPM2****	0.43399170D 01	-0.36523985D 04	0.29850045D-01
KE0740	-0.25314379D-04			433 465 0.14D-01
KE0950	G 5 RPM2****	0.11470231D 02	-0.50556512D 04	0.13641999D-01
KE0950	-0.11936343D-04			458 476 0.00D 00
KE1003	C 11 WAGNER**	-0.84860074D 01	0.13629362D 01	-0.40025845D 01
KE1003	-0.13687968D 02	0.64000000D 03	0.23199987D 01	443 486 0.41D-02
KE1020	I 4 RPM2****	0.29270221D 02	-0.73333600D 04	-0.24539657D-01
KE1020	0.14337444D-04			423 454 0.59D-03
KE1200	I 5 RPM2****	0.17958869D 02	-0.63834928D 04	-0.15442724D-02
KE1200	0.10486322D-05			480 521 0.21D-03
KE1600	I 8 RPM2****	0.16259752D 02	-0.54395626D 04	0.58457462D-04
KE1600	-0.28264046D-07			450 521 0.11D-02
KE1620	H 12 RPM2****	0.67655826D 03	-0.11139630D 06	-0.13723823D 01
KE1620	0.94992874D-03			464 500 0.35D 00

Table 12. Range 4 vapor pressure correlations--Continued

KE1700	I 4 RPM2****	0.18340928D 02	-0.64288041D 04	-0.27587607D-02
KE1700	0.18513966D-05			490 521 0.15D-03
KE2100	C 10 RPM2****	0.57404325D 02	-0.13487763D 05	-0.74065949D-01
KE2100	0.44291422D-04			493 539 0.22D-01
KE2104	C 11 RPM2****	0.33956207D 02	-0.92916871D 04	-0.29565440D-01
KE2104	0.16060508D-04			481 532 0.14D-01
KE2225	I 6 RPM2****	0.12036858D 02	-0.58199290D 04	0.10284643D-01
KE2225	-0.82201750D-05			520 564 0.24D-01
KE2365	G 26 VAPRES-2	0.16527152D 05	-0.57617584D 06	0.45684349D 01
KE2365	-0.12489337D-02	-0.27909133D 04		560 622 0.19D 00
KE2460	J 7 RIEDEL**	0.17529189D 05	-0.24029397D 04	-0.13170764D 07
KE2460	0.86815023D-15			630 651 0.18D 00
KE2506	C 6 RPM2****	0.42746661D 03	-0.84065918D 05	-0.72805420D 00
KE2506	0.42989476D-03			562 601 0.17D 00

5.2.1. Quality Ratings for Correlations

The quality rating symbols are defined in Table 13. Note that ratings A through F all involve experimental data from a "reliable source". A reliable source is one which has reported high-quality data for a large number of compounds and those data consistently agree with other good data. Only one source met these criteria for the ketone vapor pressure data--the National Physical Laboratory, Teddington, Middlesex, U. K. Very good vapor pressure data have been reported for the ketones by Collerson et al. [4418], Ambrose et al. [10253], and Ambrose et al. [10318] and, whenever a data set from one of those papers is involved, one of the A through F ratings will appear. For ratings A through C, the data from the reliable source cover the entire correlation range and the amount of corroboration from other sources ranges from substantial for A through partial for B to none for C. For ratings D through F, the reliable source data set covers only part of the correlation range and the three ratings differ only in the amount of corroborating data.

Ratings G through K do not involve a reliable source data set. A G rating tells the user that at least two data sets from different sources showed considerable agreement, whereas an H rating says that all the sources showed substantial disagreement. Both the G and H ratings indicate a better situation than the I and J ratings which indicate that only one source of data was available in any given temperature range.

Table 13. Definition of quality rating symbols for the individual property correlations

Rating	Definition
A	Correlation is based on extensive experimental data from a reliable source, and those data are substantiated by measurements from other sources over all or most of the range.
B	Correlation is based on extensive experimental data from a reliable source, but those data are substantiated by measurements from other sources over only part of the range.
C	Correlation is based on extensive experimental data from a reliable source, but the correlation is not corroborated by other measurements in any major part of the range.
D	Correlation is based on extensive experimental data from a reliable source over a major part of the range and on a less reliable data set in the other part. Data from other sources support the general validity of the correlation in both parts of the range.
E	Correlation is based on extensive experimental data from a reliable source over a major part of the range and on a less reliable data set in the other part. Data from other sources corroborate the data from the reliable source but supporting data are not available for the less reliable data set.
F	Correlation is based on extensive experimental data from a reliable source over a major part of the range and on a less reliable data set in the other part. Neither part of the correlation is corroborated by measurements from other sources.
G	Correlation is based on data from two or more overlapping sources which through their mutual agreement support the validity of the correlation through an important part of its range.
H	Correlation is based on a group of points from a single source or from multiple sources which has been selected from among various disagreeing data sets or scattered data points from several sources.

Table 13. Definition of quality rating symbols for the individual property correlations--Continued

I	Correlation is based on relatively smooth multiple data points from one source, or from two or more sources which do not overlap much, and there is little or no data available from other sources.
J	Correlation is based on scattered data points from one or two sources.
K	Correlation is just a straight line fit of only two or more data points from one or more sources.

The K rating indicates the correlation is just a straight-line fit of two or three data points. The only justification for including such correlations is the desire to provide the user with as much information as possible. Two elementary precautions were taken. First, the points fitted were usually required to be from the same source; points from different sources were used only if there were other corroborating measurements which supported the general accuracy of the two or three points fitted to the straight line. Second, the slope of the linear fit was checked to make sure it had the right sign and a reasonable numerical value. The possible pitfalls in the use of such a correlation are obvious and users are warned to be cautious in their use of property values obtained from such correlations.

In general, the quality of the experimental data base decreases as one goes from A to K in Table 13, but there can be exceptions to that rule. For example, for the D through F quality ratings, only part of the correlation is supported by a reliable source data set and it is possible for the other part to be less accurate than another correlation given a G rating. Another example concerns the I rating which presumably is superior to the J rating because the I data points are smooth whereas the J data are scattered. However, the I data may be smooth because it was reported only in equation form; it may be that the original raw data which the reporting authors smoothed were more scattered than other data sets which were given a J rating.

It is not possible to characterize precisely all the experimental circumstances which can arise with a limited number of single-character quality rating symbols, and the user may feel that the definition of the assigned rating may be imprecise in some instances. That is inevitable with only eleven symbols, but the addition of more soon becomes self-defeating. Also, the user must remember that the assigned symbol describes the total experimental data base originally available before the deletions began, and not just the final selected points which were actually correlated.

5.2.2. Vapor Pressure Correlations

Following the quality rating symbol in the first line for each compound in tables 9, 10, 11 and 12 is another item related to the quality of the correlation data base--the number of selected experimental points fitted. In general, the larger the number of points the better.

The equation used for each compound-range combination is indicated by an eight character identifier. The identifier which appears in the first line for each compound is easily related to the corresponding vapor pressure equation in table 2. The other three items following the identifier in the first line are the first three constants (A, B, C) in the correlation equation. The D constant and the E constant (Vapres-2 equation only) appear on the second line. Only the Wagner equation has six constants--the T_c and P_c values used in the correlation are listed after the A,B,C,D constants. The T_c and P_c units are kelvin and megapascals, and in this report the values listed in tables 9 through 12 will always be the same as those listed in table 7. As a matter of policy, any compound constant values which are used in any correlation are always stored in the data bank with the correlation constants--in addition to storage in the compound constants section--so that the correlation can continue to be used even if the compound constant values stored in the compound constant section are changed.

The last three items at the end of the second line are the lower temperature limit, the higher temperature limit, and the root-mean-squared-deviation (rmsd) value for the fit. The lower temperature limit is the temperature of the lowest-temperature selected data point covered by the correlation rounded down to the next integer value. The higher limit is the temperature of the highest-temperature point rounded up to the next whole number. The actual range of any specific correlation is given by these lower and upper temperature limits and not by the nominal limits for that particular temperature range defined in section 4.2.3.

The rmsd value is in kilopascals and will range from a relatively low number for the range 2 fit to a higher number for the range 4 fit, the difference being due to the different magnitudes of the data points being fitted. The large variation in the magnitude of the vapor pressure data values with temperature makes it difficult to determine the significance of a given rmsd value. One should compare rmsd values only between fits for the same temperature range but even then the comparison may be meaningless. For example, the rmsd value for a range 4 fit where the selected data points cover the entire nominal temperature range from $(T_b - 20)$ to T_c will be very different from the rmsd for another range 4 fit where the data points are limited to the range from $(T_b - 20)$ to T_b. In any case, the rmsd is an indicator primarily of the amount of scatter in the data points fitted. If the data points being fitted are the raw (unsmoothed) data points measured by the authors, a low rmsd value can be considered to be an indicator of quality. However, a very low rmsd may not be significant--it may mean that the only available experimental data were reported in equation form and hence smoothed values had to be correlated.

In a superficial judging of the quality of a correlation, the user should rely primarily on the quality rating symbol as defined in table 13. The number of points available for fitting should be considered second and the rmsd value third.

5.3. Liquid Density

Tables 14, 15, 16 and 17 contain the constants for the liquid density correlations for ranges 1, 2, 3 and 4. The organization of the tables is the same as for the vapor pressure tables (tables 9, 10, 11 and 12), with two lines per correlation. The compound identification begins both lines. The quality rating (second item on the first line) has the same significance as for the vapor pressure and is defined by Table 13. The number of experimental points actually fitted by the correlation follows the quality rating.

The equation identifier (fourth item in the first line for each compound) is related to the equations in table 3. The low-range Francis equation (identifier is FRANCIS1) has four constants, A, B, C and E; the fourth constant is E rather than D in order to avoid confusion with the symbol for the density. The T_c value (if one is available) is also stored with the low range equation. The T_c is used only in defining the fitting ranges but the $(T_c - 10)$ value used for the upper limit of the range 1 and range 4 fits with program FRANCIS1 can change enough with the T_c value to include or exclude a data point in a region where data points are sparse and thus have a relatively strong influence on the fitting process.

The high range Francis equation (identifier is FRANCIS2) sometimes used for range 4 has two adjustable constants A and B followed by the d_c and T_c values. The latter two appear in the equation and are listed here so that an old correlation will still be useable even if the values of V_c and T_c stored in the compound constants part of the data bank are changed.

Table 14. Range 1 liquid density correlations

```
KE0300  D  58  FRANCIS1   0.11210213D 01   0.10215563D-02   0.79379501D 01
KE0300   0.53905884D 03   0.50809985D 03                    178  498  0.95D-03
KE0340  K   3  FRANCIS1   0.13919132D 01   0.10882850D-02   0.00000000D 00
KE0340   0.00000000D 00                                     277  299
KE0380  H  12  FRANCIS1   0.23480034D 01   0.25871226D-02   0.31269958D 02
KE0380   0.42212915D 03   0.35713477D 03                    210  295  0.14D-02
KE0400  G  47  FRANCIS1   0.11104259D 01   0.81403158D-03   0.19753296D 02
KE0400   0.58889380D 03   0.53677979D 03                    195  324  0.17D-03
KE0420  I  13  FRANCIS1   0.12236357D 01   0.87728817D-03   0.74975948D 01
KE0420   0.52308423D 03                                     273  363  0.51D-03
KE0430  I   9  FRANCIS1   0.14537134D 01   0.10908672D-02   0.14505398D 02
KE0430   0.65764941D 03                                     282  303  0.14D-03
KE0500  H   9  FRANCIS1   0.10936251D 01   0.96370699D-03   0.48774409D 00
KE0500   0.42092505D 03   0.56107983D 03                    233  354  0.11D-03
KE0501  H  19  FRANCIS1   0.10943232D 01   0.86304802D-03   0.70360441D 01
KE0501   0.55340259D 03   0.56145996D 03                    273  348  0.66D-04
KE0505  K   3  FRANCIS1   0.10588190D 01   0.84827400D-03   0.00000000D 00
KE0505   0.00000000D 00                                     283  324
KE0510  H  27  FRANCIS1   0.12644968D 01   0.89787156D-03   0.80934544D 01
KE0510   0.61981030D 03                                     277  374  0.20D-03
KE0520  H  15  FRANCIS1   0.12307463D 01   0.95416536D-03   0.36097822D 01
KE0520   0.17891855D 04                                     273  364  0.12D-03
KE0530  I   4  FRANCIS1   0.11695671D 01   0.90240128D-03   0.82282317D 00
KE0530   0.43741748D 03                                     293 . 361  0.59D-04
KE0540  K   3  FRANCIS1   0.11309113D 01   0.95017100D-03   0.00000000D 00
KE0540   0.00000000D 00                                     293  299
KE0563  K   2  FRANCIS1   0.12291625D 01   0.82216200D-03   0.00000000D 00
KE0563   0.00000000D 00                                     293  299
KE0568  K   2  FRANCIS1   0.14145337D 01   0.11002640D-02   0.00000000D 00
KE0568   0.00000000D 00                                     293  299
KE0600  H   7  FRANCIS1   0.10629501D 01   0.76617324D-03   0.67085629D 01
KE0600   0.54074902D 03   0.58700000D 03                    283  334  0.18D-03
KE0601  I   4  FRANCIS1   0.10622683D 01   0.75031724D-03   0.48805723D 01
KE0601   0.47581445D 03   0.58281982D 03                    297  324  0.14D-04
KE0604  H  18  FRANCIS1   0.10666428D 01   0.82335575D-03   0.69826603D 01
KE0604   0.57530029D 03   0.57100000D 03                    273  374  0.11D-03
KE0607  I  13  FRANCIS1   0.10912037D 01   0.94584492D-03   0.63908215D 01
KE0607   0.12265347D 04   0.56700000D 03                    293  354  0.29D-04
KE0610  K   2  FRANCIS1   0.11699327D 01   0.67871500D-03   0.00000000D 00
KE0610   0.00000000D 00                                     293  299
KE0615  J  21  FRANCIS1   0.12592354D 01   0.73114224D-03   0.24115524D 02
KE0615   0.65499878D 03                                     277  374  0.51D-03
KE0620  H  15  FRANCIS1   0.12110815D 01   0.84087066D-03   0.62623587D 01
KE0620   0.64040259D 03   0.62900000D 03                    273  354  0.49D-04
KE0625  K   3  FRANCIS1   0.11754525D 01   0.89549800D-03   0.00000000D 00
KE0625   0.00000000D 00                                     293  361
KE0650  I   6  FRANCIS1   0.11541748D 01   0.92861406D-03   0.12769001D 02
KE0650   0.83510986D 03                                     293  394  0.43D-04
KE0660  I   4  FRANCIS1   0.15105515D 01   0.97980653D-03   0.19811020D 02
KE0660   0.90835181D 03                                     395  434  0.17D-03
KE0670  I   6  FRANCIS1   0.12066355D 01   0.88522420D-03   0.25476007D 01
KE0670   0.59638232D 03                                     293  394  0.18D-03
```

Table 14. Range 1 liquid density correlations--Continued

KE0700	G 16 FRANCIS1	0.10823164D 01	0.68128319D-03	0.28077332D 02
KE0700	0.71180640D 03	0.61150000D 03		288 429 0.10D-03
KE0701	I 7 FRANCIS1	0.10566082D 01	0.76659396D-03	0.29826403D 01
KE0701	0.51027295D 03			288 360 0.14D-03
KE0702	H 10 FRANCIS1	0.10744505D 01	0.73973392D-03	0.12342205D 02
KE0702	0.59130103D 03			253 394 0.41D-03
KE0720	G 24 FRANCIS1	0.10650043D 01	0.79409732D-03	0.79816027D 01
KE0720	0.59359106D 03			283 374 0.39D-03
KE0725	I 20 FRANCIS1	0.12179537D 01	0.80069271D-03	0.10817964D 02
KE0725	0.63199292D 03			288 374 0.18D-03
KE0730	I 18 FRANCIS1	0.12222862D 01	0.81374589D-03	0.84028273D 01
KE0730	0.60423389D 03			277 374 0.10D-03
KE0735	I 13 FRANCIS1	0.13543797D 01	0.89812255D-03	0.94656706D 01
KE0735	0.10463357D 04			313 374 0.31D-03
KE0740	I 7 FRANCIS1	0.11986494D 01	0.81006484D-03	0.38449039D 01
KE0740	0.65876953D 03			297 374 0.75D-04
KE0745	J 7 FRANCIS1	0.11601934D 01	0.70832646D-03	0.10340004D 02
KE0745	0.66066748D 03			292 357 0.14D-02
KE0746	J 6 FRANCIS1	0.11473150D 01	0.77219424D-03	0.26848648D 02
KE0746	0.44958086D 04			291 361 0.78D-03
KE0747	G 8 FRANCIS1	0.11351528D 01	0.70543634D-03	0.90721703D 00
KE0747	0.37699731D 03			291 360 0.37D-02
KE0760	I 5 FRANCIS1	0.13968458D 01	0.88775204D-03	0.16219463D 01
KE0760	0.61806470D 03			348 401 0.42D-03
KE0800	H 17 FRANCIS1	0.10774565D 01	0.79408265D-03	0.89678802D 01
KE0800	0.64906519D 03			253 434 0.26D-03
KE0801	I 6 FRANCIS1	0.10447025D 01	0.75790938D-03	0.56298885D-01
KE0801	0.37720679D 03			293 360 0.13D-03
KE0802	K 3 FRANCIS1	0.10581158D 01	0.81718800D-03	0.00000000D 00
KE0802	0.00000000D 00			297 324
KE0850	K 2 FRANCIS1	0.10557714D 01	0.85020700D-03	0.00000000D 00
KE0850	0.00000000D 00			293 299
KE0890	I 8 FRANCIS1	0.11752396D 01	0.74465154D-03	0.23469505D 01
KE0890	0.55955298D 03			329 412 0.72D-04
KE0910	K 3 FRANCIS1	0.11457132D 01	0.83233000D-03	0.00000000D 00
KE0910	0.00000000D 00			273 294
KE0930	I 20 FRANCIS1	0.12116728D 01	0.71956799D-03	0.64043417D 01
KE0930	0.51158325D 03			277 374 0.13D-03
KE0950	H 17 FRANCIS1	0.12849731D 01	0.82102115D-03	0.73394318D 01
KE0950	0.74487476D 03			293 475 0.84D-04
KE0980	K 2 FRANCIS1	0.14689927D 01	0.94420500D-03	0.00000000D 00
KE0980	0.00000000D 00			293 299
KE1000	H 16 FRANCIS1	0.10667076D 01	0.69098081D-03	0.18308731D 02
KE1000	0.71997681D 03			298 439 0.74D-04
KE1001	J 4 FRANCIS1	0.10525827D 01	0.76424866D-03	0.19214630D 02
KE1001	0.30584688D 04			293 359 0.25D-02
KE1002	K 3 FRANCIS1	0.10635706D 01	0.82080900D-03	0.00000000D 00
KE1002	0.00000000D 00			297 324
KE1003	H 8 FRANCIS1	0.10534096D 01	0.79098716D-03	0.49999952D-02
KE1003	0.88935620D 03	0.64000000D 03		283 360 0.49D-03
KE1020	I 6 FRANCIS1	0.10386066D 01	0.75689703D-03	0.34747953D 01
KE1020	0.60697998D 03			293 359 0.22D-03

Table 14. Range 1 liquid density correlations--Continued

KE1040	K 2 FRANCIS1	0.10481059D 01	0.76418900D-03	0.00000000D 00
KE1040	0.00000000D 00			293 299
KE1150	I 4 FRANCIS1	0.11017246D 01	0.64413319D-03	0.50127020D 01
KE1150	0.49241553D 03			303 363 0.56D-05
KE1180	I 4 FRANCIS1	0.12283163D 01	0.72272122D-03	0.87706625D 00
KE1180	0.43193555D 03			293 359 0.10D-03
KE1181	I 7 FRANCIS1	0.12354736D 01	0.75112213D-03	0.29371872D 01
KE1181	0.51115088D 03			293 359 0.28D-03
KE1250	I 9 FRANCIS1	0.13698235D 01	0.83868415D-03	0.96535120D 01
KE1250	0.10811353D 04			313 354 0.22D-03
KE1320	K 2 FRANCIS1	0.11775263D 01	0.82878800D-03	0.00000000D 00
KE1320	0.00000000D 00			289 294
KE1350	K 3 FRANCIS1	0.19414714D 01	0.12592340D-02	0.00000000D 00
KE1350	0.00000000D 00			306 347
KE1360	K 3 FRANCIS1	0.14523771D 01	0.95708700D-03	0.00000000D 00
KE1360	0.00000000D 00			292 362
KE1400	K 3 FRANCIS1	0.10606149D 01	0.80690800D-03	0.00000000D 00
KE1400	0.00000000D 00			288 304
KE1401	I 4 FRANCIS1	0.10355082D 01	0.68153860D-03	0.24201708D 01
KE1401	0.52146802D 03			293 359 0.71D-04
KE1403	K 3 FRANCIS1	0.10556330D 01	0.78969400D-03	0.00000000D 00
KE1403	0.00000000D 00			297 324
KE1530	I 7 FRANCIS1	0.11216106D 01	0.75179804D-03	0.11565094D 01
KE1530	0.58048584D 03			273 374 0.47D-04
KE1550	I 5 FRANCIS1	0.11585274D 01	0.88412291D-03	0.99014626D 01
KE1550	0.11632017D 04			287 294 0.14D-04
KE1580	J 6 FRANCIS1	0.11929045D 01	0.71501243D-03	0.31916519D 02
KE1580	0.73905195D 04			291 359 0.76D-03
KE1620	K 3 FRANCIS1	0.12227294D 01	0.85964500D-03	0.00000000D 00
KE1620	0.00000000D 00			453 474
KE1640	K 3 FRANCIS1	0.11054682D 01	0.64550500D-03	0.00000000D 00
KE1640	0.00000000D 00			286 294
KE1660	K 2 FRANCIS1	0.12286730D 01	0.10305550D-02	0.00000000D 00
KE1660	0.00000000D 00			289 294
KE1680	K 2 FRANCIS1	0.12271983D 01	0.10002810D-02	0.00000000D 00
KE1680	0.00000000D 00			288 294
KE1750	I 7 FRANCIS1	0.11910629D 01	0.65790350D-03	0.14866219D 01
KE1750	0.44262402D 03			291 360 0.26D-03
KE1760	I 4 FRANCIS1	0.12143669D 01	0.77111414D-03	0.56137331D-01
KE1760	0.37699731D 03			293 360 0.21D-04
KE1762	I 4 FRANCIS1	0.11962500D 01	0.70684613D-03	0.24943739D 00
KE1762	0.39578760D 03			298 361 0.45D-06
KE1860	I 8 FRANCIS1	0.13859816D 01	0.94468961D-03	0.49999952D-02
KE1860	0.49347217D 03			333 374 0.92D-03
KE2000	I 4 FRANCIS1	0.16353292D 01	0.10515784D-02	0.53056593D 01
KE2000	0.85100244D 03			296 354 0.18D-03
KE2100	G 28 FRANCIS1	0.10617561D 01	0.66399807D-03	0.19551086D 02
KE2100	0.76776074D 03			293 434 0.88D-04
KE2104	I 5 FRANCIS1	0.10162287D 01	0.57980116D-03	0.45092754D 01
KE2104	0.50070825D 03			293 360 0.12D-03
KE2120	I 9 FRANCIS1	0.11690245D 01	0.72760601D-03	0.35297394D 01
KE2120	0.16314060D 04			301 412 0.11D-03

Table 14. Range 1 liquid density correlations--Continued

```
KE2130  I   4  FRANCIS1   0.12822104D 01   0.88562258D-03   0.85805788D 01
KE2130   0.38810552D 04                                    289  352  0.20D-03
KE2150  I   9  FRANCIS1   0.12204685D 01   0.79455716D-03   0.14701186D 02
KE2150   0.12922126D 04                                    292  355  0.11D-03
KE2155  I   4  FRANCIS1   0.12095985D 01   0.79942029D-03   0.79448156D 01
KE2155   0.24433069D 04                                    293  360  0.24D-03
KE2170  K   2  FRANCIS1   0.12807347D 01   0.86907800D-03   0.00000000D 00
KE2170   0.00000000D 00                                    287  294
KE2190  K   3  FRANCIS1   0.16299756D 01   0.10330470D-02   0.00000000D 00
KE2190   0.00000000D 00                                    362  407
KE2225  I   6  FRANCIS1   0.11714888D 01   0.66504418D-03   0.63866241D 02
KE2225   0.22372144D 04                                    343  416  0.17D-03
KE2235  K   3  FRANCIS1   0.11643365D 01   0.87794400D-03   0.00000000D 00
KE2235   0.00000000D 00                                    288  294
KE2250  I   8  FRANCIS1   0.11945877D 01   0.78531238D-03   0.15419426D 02
KE2250   0.65498828D 04                                    299  354  0.13D-03
KE2260  I   4  FRANCIS1   0.13363056D 01   0.72387094D-03   0.21761551D 02
KE2260   0.45346445D 04                                    293  359  0.26D-03
KE2300  I  14  FRANCIS1   0.10458326D 01   0.69680461D-03   0.47666807D 01
KE2300   0.67093164D 03                                    303  434  0.28D-04
KE2350  I   4  FRANCIS1   0.11599350D 01   0.66308654D-03   0.26666517D 01
KE2350   0.49937061D 03                                    294  354  0.12D-03
KE2365  H  16  FRANCIS1   0.13401823D 01   0.75588422D-03   0.45055351D 01
KE2365   0.69762964D 03                                    328  524  0.21D-03
KE2380  I   4  FRANCIS1   0.13082275D 01   0.72633754D-03   0.51078349D-02
KE2380   0.38099902D 03                                    293  359  0.23D-04
KE2430  I   7  FRANCIS1   0.14260750D 01   0.73180185D-03   0.32127676D 01
KE2430   0.16007200D 04                                    403  461  0.72D-03
KE2445  I   4  FRANCIS1   0.12868528D 01   0.70454692D-03   0.12738742D 02
KE2445   0.17073696D 04                                    293  359  0.38D-03
KE2460  K   2  FRANCIS1   0.15605904D 01   0.87257900D-03   0.00000000D 00
KE2460   0.00000000D 00                                    565  576
KE2506  K   3  FRANCIS1   0.10552623D 01   0.76081000D-03   0.00000000D 00
KE2506   0.00000000D 00                                    312  354
KE2540  I   8  FRANCIS1   0.11673403D 01   0.70211850D-03   0.19182373D 02
KE2540   0.99052905D 03                                    293  354  0.10D-03
KE2565  I   4  FRANCIS1   0.12601871D 01   0.69377758D-03   0.52163324D 01
KE2565   0.12629890D 04                                    293  359  0.11D-03
KE2630  I   4  FRANCIS1   0.13531923D 01   0.77704038D-03   0.37081345D 02
KE2630   0.17556663D 04                                    348  407  0.29D-03
KE2645  I   4  FRANCIS1   0.12418633D 01   0.70035667D-03   0.49999952D-02
KE2645   0.80786211D 04                                    293  359  0.23D-03
KE2680  J   4  FRANCIS1   0.15772915D 01   0.82694599D-03   0.15674782D 03
KE2680   0.31303765D 04                                    367  427  0.41D-02
KE2685  I   4  FRANCIS1   0.17867718D 01   0.96267578D-03   0.19923569D 02
KE2685   0.15690449D 04                                    346  409  0.82D-03
KE2688  I   4  FRANCIS1   0.15926456D 01   0.86395908D-03   0.50203278D 02
KE2688   0.44107930D 04                                    367  423  0.84D-03
KE2707  K   2  FRANCIS1   0.10381524D 01   0.69986300D-03   0.00000000D 00
KE2707   0.00000000D 00                                    333  354
KE2745  K   3  FRANCIS1   0.13130190D 01   0.71617300D-03   0.00000000D 00
KE2745   0.00000000D 00                                    391  445
```

Table 14. Range 1 liquid density correlations--Continued

KE2755	I	4	FRANCIS1	0.12268534D 01	0.67655882D-03	0.18401814D 01
KE2755	0.69340601D 03				293 359 0.49D-04	
KE2835	I	5	FRANCIS1	0.11383848D 01	0.66913106D-03	0.49246109D 02
KE2835	0.24330369D 04				319 357 0.15D-03	
KE2845	I	4	FRANCIS1	0.12137480D 01	0.67674927D-03	0.45696878D 01
KE2845	0.12091201D 04				293 359 0.89D-04	
KE3050	I	5	FRANCIS1	0.11290541D 01	0.66905282D-03	0.51053818D 02
KE3050	0.27560354D 04				328 355 0.14D-03	
KE3310	K	2	FRANCIS1	0.10338106D 01	0.67308100D-03	0.00000000D 00
KE3310	0.00000000D 00				343 365	
KE3350	I	5	FRANCIS1	0.11021729D 01	0.68568555D-03	0.27912140D 00
KE3350	0.60188306D 03				353 574 0.63D-03	
KE3712	K	2	FRANCIS1	0.10227895D 01	0.63346800D-03	0.00000000D 00
KE3712	0.00000000D 00				353 365	
KE4114	J	5	FRANCIS1	0.10310059D 01	0.64559188D-03	0.19765949D 00
KE4114	0.75869238D 03				363 574 0.13D-02	
KE4516	K	2	FRANCIS1	0.10552416D 01	0.71184300D-03	0.00000000D 00
KE4516	0.00000000D 00				361 369	

Table 15. Range 2 liquid density correlations

```
KE0300  A  34  FRANCIS1   0.11081915D 01   0.10551438D-02   0.96902567D 00
KE0300   0.40312988D 03   0.50809985D 03                    178  330  0.20D-03
KE0340  K   3  FRANCIS1   0.13919132D 01   0.10882850D-02   0.00000000D 00
KE0340   0.00000000D 00                                     277  299
KE0380  H  12  FRANCIS1   0.23480034D 01   0.25871226D-02   0.31269958D 02
KE0380   0.42212915D 03   0.35713477D 03                    210  295  0.14D-02
KE0400  G  47  FRANCIS1   0.11104259D 01   0.81403158D-03   0.19753296D 02
KE0400   0.58889380D 03   0.53677979D 03                    195  324  0.17D-03
KE0420  I  13  FRANCIS1   0.12236357D 01   0.87728817D-03   0.74975948D 01
KE0420   0.52308423D 03                                     273  363  0.51D-03
KE0430  I   9  FRANCIS1   0.14537134D 01   0.10908672D-02   0.14505398D 02
KE0430   0.65764941D 03                                     282  303  0.14D-03
KE0500  H   9  FRANCIS1   0.10936251D 01   0.96370699D-03   0.48774409D 00
KE0500   0.42092505D 03   0.56107983D 03                    233  354  0.11D-03
KE0501  H  19  FRANCIS1   0.10943232D 01   0.86304802D-03   0.70360441D 01
KE0501   0.55340259D 03   0.56145996D 03                    273  348  0.66D-04
KE0505  K   3  FRANCIS1   0.10588190D 01   0.84827400D-03   0.00000000D 00
KE0505   0.00000000D 00                                     283  324
KE0510  H  27  FRANCIS1   0.12644968D 01   0.89787156D-03   0.80934544D 01
KE0510   0.61981030D 03                                     277  374  0.20D-03
KE0520  H  15  FRANCIS1   0.12307463D 01   0.95416536D-03   0.36097822D 01
KE0520   0.17891855D 04                                     273  364  0.12D-03
KE0530  I   4  FRANCIS1   0.11695671D 01   0.90240128D-03   0.82282317D 00
KE0530   0.43741748D 03                                     293  361  0.59D-04
KE0540  K   3  FRANCIS1   0.11309113D 01   0.95017100D-03   0.00000000D 00
KE0540   0.00000000D 00                                     293  299
KE0563  K   2  FRANCIS1   0.12291625D 01   0.82216200D-03   0.00000000D 00
KE0563   0.00000000D 00                                     293  299
KE0568  K   2  FRANCIS1   0.14145337D 01   0.11002640D-02   0.00000000D 00
KE0568   0.00000000D 00                                     293  299
KE0600  H   7  FRANCIS1   0.10629501D 01   0.76617324D-03   0.67085629D 01
KE0600   0.54074902D 03   0.58700000D 03                    283  334  0.18D-03
KE0601  I   4  FRANCIS1   0.10622683D 01   0.75031724D-03   0.48805723D 01
KE0601   0.47581445D 03   0.58281982D 03                    297  324  0.14D-04
KE0604  H  18  FRANCIS1   0.10666428D 01   0.82335575D-03   0.69826603D 01
KE0604   0.57530029D 03   0.57100000D 03                    273  374  0.11D-03
KE0607  I  13  FRANCIS1   0.10912037D 01   0.94584492D-03   0.63908215D 01
KE0607   0.12265347D 04   0.56700000D 03                    293  354  0.29D-04
KE0610  K   2  FRANCIS1   0.11699327D 01   0.67871500D-03   0.00000000D 00
KE0610   0.00000000D 00                                     293  299
KE0615  J  21  FRANCIS1   0.12592354D 01   0.73114224D-03   0.24115524D 02
KE0615   0.65499878D 03                                     277  374  0.51D-03
KE0620  H  15  FRANCIS1   0.12110815D 01   0.84087066D-03   0.62623587D 01
KE0620   0.64040259D 03   0.62900000D 03                    273  354  0.49D-04
KE0625  K   3  FRANCIS1   0.11754525D 01   0.89549800D-03   0.00000000D 00
KE0625   0.00000000D 00                                     293  361
KE0650  I   6  FRANCIS1   0.11541748D 01   0.92861406D-03   0.12769001D 02
KE0650   0.83510986D 03                                     293  394  0.43D-04
KE0660  I   4  FRANCIS1   0.15105515D 01   0.97980653D-03   0.19811020D 02
KE0660   0.90835181D 03                                     395  434  0.17D-03
KE0670  I   6  FRANCIS1   0.12066355D 01   0.88522420D-03   0.25476007D 01
KE0670   0.59638232D 03                                     293  394  0.18D-03
```

Table 15. Range 2 liquid density correlations--Continued

KE1040	K 2 FRANCIS1	0.10481059D 01	0.76418900D-03	0.00000000D 00
KE1040	0.00000000D 00			293 299
KE1150	I 4 FRANCIS1	0.11017246D 01	0.64413319D-03	0.50127020D 01
KE1150	0.49241553D 03			303 363 0.56D-05
KE1180	I 4 FRANCIS1	0.12283163D 01	0.72272122D-03	0.87706625D 00
KE1180	0.43193555D 03			293 359 0.10D-03
KE1181	I 7 FRANCIS1	0.12354736D 01	0.75112213D-03	0.29371872D 01
KE1181	0.51115088D 03			293 359 0.28D-03
KE1250	I 9 FRANCIS1	0.13698235D 01	0.83868415D-03	0.96535120D 01
KE1250	0.10811353D 04			313 354 0.22D-03
KE1320	K 2 FRANCIS1	0.11775263D 01	0.82878800D-03	0.00000000D 00
KE1320	0.00000000D 00			289 294
KE1350	K 3 FRANCIS1	0.19414714D 01	0.12592340D-02	0.00000000D 00
KE1350	0.00000000D 00			306 347
KE1360	K 3 FRANCIS1	0.14523771D 01	0.95708700D-03	0.00000000D 00
KE1360	0.00000000D 00			292 362
KE1400	K 3 FRANCIS1	0.10606149D 01	0.80690800D-03	0.00000000D 00
KE1400	0.00000000D 00			288 304
KE1401	I 4 FRANCIS1	0.10355082D 01	0.68153860D-03	0.24201708D 01
KE1401	0.52146802D 03			293 359 0.71D-04
KE1403	K 3 FRANCIS1	0.10556330D 01	0.78969400D-03	0.00000000D 00
KE1403	0.00000000D 00			297 324
KE1530	I 7 FRANCIS1	0.11216106D 01	0.75179804D-03	0.11565094D 01
KE1530	0.58048584D 03			273 374 0.47D-04
KE1550	I 5 FRANCIS1	0.11585274D 01	0.88412291D-03	0.99014626D 01
KE1550	0.11632017D 04			287 294 0.14D-04
KE1580	J 6 FRANCIS1	0.11929045D 01	0.71501243D-03	0.31916519D 02
KE1580	0.73905195D 04			291 359 0.76D-03
KE1620	K 3 FRANCIS1	0.12227294D 01	0.85964500D-03	0.00000000D 00
KE1620	0.00000000D 00			453 474
KE1640	K 3 FRANCIS1	0.11054682D 01	0.64550500D-03	0.00000000D 00
KE1640	0.00000000D 00			286 294
KE1660	K 2 FRANCIS1	0.12286730D 01	0.10305550D-02	0.00000000D 00
KE1660	0.00000000D 00			289 294
KE1680	K 2 FRANCIS1	0.12271983D 01	0.10002810D-02	0.00000000D 00
KE1680	0.00000000D 00			288 294
KE1750	I 7 FRANCIS1	0.11910629D 01	0.65790350D-03	0.14866219D 01
KE1750	0.44262402D 03			291 360 0.26D-03
KE1760	I 4 FRANCIS1	0.12143669D 01	0.77111414D-03	0.56137331D-01
KE1760	0.37699731D 03			293 360 0.21D-04
KE1762	I 4 FRANCIS1	0.11962500D 01	0.70684613D-03	0.24943739D 00
KE1762	0.39578760D 03			298 361 0.45D-06
KE1860	I 8 FRANCIS1	0.13859816D 01	0.94468961D-03	0.49999952D-02
KE1860	0.49347217D 03			333 374 0.92D-03
KE2000	I 4 FRANCIS1	0.16353292D 01	0.10515784D-02	0.53056593D 01
KE2000	0.85100244D 03			296 354 0.18D-03
KE2100	G 28 FRANCIS1	0.10617561D 01	0.66399807D-03	0.19551086D 02
KE2100	0.76776074D 03			293 434 0.88D-04
KE2104	I 5 FRANCIS1	0.10162287D 01	0.57980116D-03	0.45092754D 01
KE2104	0.50070825D 03			293 360 0.12D-03
KE2120	I 9 FRANCIS1	0.11690245D 01	0.72760601D-03	0.35297394D 01
KE2120	0.16314060D 04			301 412 0.11D-03

Table 15. Range 2 liquid density correlations--Continued

```
KE0700  G  16  FRANCIS1   0.10823164D 01   0.68128319D-03   0.28077332D 02
KE0700   0.71180640D 03   0.61150000D 03                    288  429  0.10D-03
KE0701  I   7  FRANCIS1   0.10566082D 01   0.76659396D-03   0.29826403D 01
KE0701   0.51027295D 03                                     288  360  0.14D-03
KE0702  H  10  FRANCIS1   0.10744505D 01   0.73973392D-03   0.12342205D 02
KE0702   0.59130103D 03                                     253  394  0.41D-03
KE0720  G  24  FRANCIS1   0.10650043D 01   0.79409732D-03   0.79816027D 01
KE0720   0.59359106D 03                                     283  374  0.39D-03
KE0725  I  20  FRANCIS1   0.12179537D 01   0.80069271D-03   0.10817964D 02
KE0725   0.63199292D 03                                     288  374  0.18D-03
KE0730  I  18  FRANCIS1   0.12222862D 01   0.81374589D-03   0.84028273D 01
KE0730   0.60423389D 03                                     277  374  0.10D-03
KE0735  I  13  FRANCIS1   0.13543797D 01   0.89812255D-03   0.94656706D 01
KE0735   0.10463357D 04                                     313  374  0.31D-03
KE0740  I   7  FRANCIS1   0.11986494D 01   0.81006484D-03   0.38449039D 01
KE0740   0.65876953D 03                                     297  374  0.75D-04
KE0745  J   7  FRANCIS1   0.11601934D 01   0.70832646D-03   0.10340004D 02
KE0745   0.66066748D 03                                     292  357  0.14D-02
KE0746  J   6  FRANCIS1   0.11473150D 01   0.77219424D-03   0.26848648D 02
KE0746   0.44958086D 04                                     291  361  0.78D-03
KE0747  G   8  FRANCIS1   0.11351528D 01   0.70543634D-03   0.90721703D 00
KE0747   0.37699731D 03                                     291  360  0.37D-02
KE0760  I   5  FRANCIS1   0.13968458D 01   0.88775204D-03   0.16219463D 01
KE0760   0.61806470D 03                                     348  401  0.42D-03
KE0800  H  17  FRANCIS1   0.10774565D 01   0.79408265D-03   0.89678802D 01
KE0800   0.64906519D 03                                     253  434  0.26D-03
KE0801  I   6  FRANCIS1   0.10447025D 01   0.75790938D-03   0.56298885D-01
KE0801   0.37720679D 03                                     293  360  0.13D-03
KE0802  K   3  FRANCIS1   0.10581158D 01   0.81718800D-03   0.00000000D 00
KE0802   0.00000000D 00                                     297  324
KE0850  K   2  FRANCIS1   0.10557714D 01   0.85020700D-03   0.00000000D 00
KE0850   0.00000000D 00                                     293  299
KE0890  I   8  FRANCIS1   0.11752396D 01   0.74465154D-03   0.23469505D 01
KE0890   0.55955298D 03                                     329  412  0.72D-04
KE0910  K   3  FRANCIS1   0.11457132D 01   0.83233000D-03   0.00000000D 00
KE0910   0.00000000D 00                                     273  294
KE0930  I  20  FRANCIS1   0.12116728D 01   0.71956799D-03   0.64043417D 01
KE0930   0.51158325D 03                                     277  374  0.13D-03
KE0950  H  17  FRANCIS1   0.12849731D 01   0.82102115D-03   0.73394318D 01
KE0950   0.74487476D 03                                     293  475  0.84D-04
KE0980  K   2  FRANCIS1   0.14689927D 01   0.94420500D-03   0.00000000D 00
KE0980   0.00000000D 00                                     293  299
KE1000  H  16  FRANCIS1   0.10667076D 01   0.69098081D-03   0.18308731D 02
KE1000   0.71997681D 03                                     298  439  0.74D-04
KE1001  J   4  FRANCIS1   0.10525827D 01   0.76424866D-03   0.19214630D 02
KE1001   0.30584688D 04                                     293  359  0.25D-02
KE1002  K   3  FRANCIS1   0.10635706D 01   0.82080900D-03   0.00000000D 00
KE1002   0.00000000D 00                                     297  324
KE1003  H   8  FRANCIS1   0.10534096D 01   0.79098716D-03   0.49999952D-02
KE1003   0.88935620D 03   0.64000000D 03                    283  360  0.49D-03
KE1020  I   6  FRANCIS1   0.10386066D 01   0.75689703D-03   0.34747953D 01
KE1020   0.60697998D 03                                     293  359  0.22D-03
```

Table 15. Range 2 liquid density correlations--Continued

```
KE2130  I   4  FRANCIS1  0.12822104D 01   0.88562258D-03   0.85805788D 01
KE2130   0.38810552D 04                                    289  352  0.20D-03
KE2150  I   9  FRANCIS1  0.12204685D 01   0.79455716D-03   0.14701186D 02
KE2150   0.12922126D 04                                    292  355  0.11D-03
KE2155  I   4  FRANCIS1  0.12095985D 01   0.79942029D-03   0.79448156D 01
KE2155   0.24433069D 04                                    293  360  0.24D-03
KE2170  K   2  FRANCIS1  0.12807347D 01   0.86907800D-03   0.00000000D 00
KE2170   0.00000000D 00                                    287  294
KE2190  K   3  FRANCIS1  0.16299756D 01   0.10330470D-02   0.00000000D 00
KE2190   0.00000000D 00                                    362  407
KE2225  I   6  FRANCIS1  0.11714888D 01   0.66504418D-03   0.63866241D 02
KE2225   0.22372144D 04                                    343  416  0.17D-03
KE2235  K   3  FRANCIS1  0.11643365D 01   0.87794400D-03   0.00000000D 00
KE2235   0.00000000D 00                                    288  294
KE2250  I   8  FRANCIS1  0.11945877D 01   0.78531238D-03   0.15419426D 02
KE2250   0.65498828D 04                                    299  354  0.13D-03
KE2260  I   4  FRANCIS1  0.13363056D 01   0.72387094D-03   0.21761551D 02
KE2260   0.45346445D 04                                    293  359  0.26D-03
KE2300  I  14  FRANCIS1  0.10458326D 01   0.69680461D-03   0.47666807D 01
KE2300   0.67093164D 03                                    303  434  0.28D-04
KE2350  I   4  FRANCIS1  0.11599350D 01   0.66308654D-03   0.26666517D 01
KE2350   0.49937061D 03                                    294  354  0.12D-03
KE2365  H  16  FRANCIS1  0.13401823D 01   0.75588422D-03   0.45055351D 01
KE2365   0.69762964D 03                                    328  524  0.21D-03
KE2380  I   4  FRANCIS1  0.13082275D 01   0.72633754D-03   0.51078349D-02
KE2380   0.38099902D 03                                    293  359  0.23D-04
KE2430  I   7  FRANCIS1  0.14260750D 01   0.73180185D-03   0.32127676D 01
KE2430   0.16007200D 04                                    403  461  0.72D-03
KE2445  I   4  FRANCIS1  0.12868528D 01   0.70454692D-03   0.12738742D 02
KE2445   0.17073696D 04                                    293  359  0.38D-03
KE2460  K   2  FRANCIS1  0.15605904D 01   0.87257900D-03   0.00000000D 00
KE2460   0.00000000D 00                                    565  576
KE2506  K   3  FRANCIS1  0.10552623D 01   0.76081000D-03   0.00000000D 00
KE2506   0.00000000D 00                                    312  354
KE2540  I   8  FRANCIS1  0.11673403D 01   0.70211850D-03   0.19182373D 02
KE2540   0.99052905D 03                                    293  354  0.10D-03
KE2565  I   4  FRANCIS1  0.12601871D 01   0.69377758D-03   0.52163324D 01
KE2565   0.12629890D 04                                    293  359  0.11D-03
KE2630  I   4  FRANCIS1  0.13531923D 01   0.77704038D-03   0.37081345D 02
KE2630   0.17556663D 04                                    348  407  0.29D-03
KE2645  I   4  FRANCIS1  0.12418633D 01   0.70035667D-03   0.49999952D-02
KE2645   0.80786211D 04                                    293  359  0.23D-03
KE2680  J   4  FRANCIS1  0.15772915D 01   0.82694599D-03   0.15674782D 03
KE2680   0.31303765D 04                                    367  427  0.41D-02
KE2685  I   4  FRANCIS1  0.17867718D 01   0.96267578D-03   0.19923569D 02
KE2685   0.15690449D 04                                    346  409  0.82D-03
KE2688  I   4  FRANCIS1  0.15926456D 01   0.86395908D-03   0.50203278D 02
KE2688   0.44107930D 04                                    367  423  0.84D-03
KE2707  K   2  FRANCIS1  0.10381524D 01   0.69986300D-03   0.00000000D 00
KE2707   0.00000000D 00                                    333  354
KE2745  K   3  FRANCIS1  0.13130190D 01   0.71617300D-03   0.00000000D 00
KE2745   0.00000000D 00                                    391  445
```

Table 15. Range 2 liquid density correlations--Continued

KE2755	I 4 FRANCIS1	0.12268534D 01	0.67655882D-03	0.18401814D 01
KE2755	0.69340601D 03			293 359 0.49D-04
KE2835	I 5 FRANCIS1	0.11383848D 01	0.66913106D-03	0.49246109D 02
KE2835	0.24330369D 04			319 357 0.15D-03
KE2845	I 4 FRANCIS1	0.12137480D 01	0.67674927D-03	0.45696878D 01
KE2845	0.12091201D 04			293 359 0.89D-04
KE3050	I 5 FRANCIS1	0.11290541D 01	0.66905282D-03	0.51053818D 02
KE3050	0.27560354D 04			328 355 0.14D-03
KE3310	K 2 FRANCIS1	0.10338106D 01	0.67308100D-03	0.00000000D 00
KE3310	0.00000000D 00			343 365
KE3350	I 5 FRANCIS1	0.11021729D 01	0.68568555D-03	0.27912140D 00
KE3350	0.60188306D 03			353 574 0.63D-03
KE3712	K 2 FRANCIS1	0.10227895D 01	0.63346800D-03	0.00000000D 00
KE3712	0.00000000D 00			353 365
KE4114	J 5 FRANCIS1	0.10310059D 01	0.64559188D-03	0.19765949D 00
KE4114	0.75869238D 03			363 574 0.13D-02
KE4516	K 2 FRANCIS1	0.10552416D 01	0.71184300D-03	0.00000000D 00
KE4516	0.00000000D 00			361 369

Table 16. Range 3 liquid density correlations

```
KE0300  D  53  FRANCIS1   0.11216850D 01   0.97801606D-03   0.12052504D 02
KE0300   0.55959619D 03   0.50809985D 03                    178  476  0.71D-03
KE0340  K   3  FRANCIS1   0.13919132D 01   0.10882850D-02   0.00000000D 00
KE0340   0.00000000D 00                                     277  299
KE0380  H  12  FRANCIS1   0.23480034D 01   0.25871226D-02   0.31269958D 02
KE0380   0.42212915D 03   0.35713477D 03                    210  295  0.14D-02
KE0400  G  47  FRANCIS1   0.11104259D 01   0.81403158D-03   0.19753296D 02
KE0400   0.58889380D 03   0.53677979D 03                    195  324  0.17D-03
KE0420  I  13  FRANCIS1   0.12236357D 01   0.87728817D-03   0.74975948D 01
KE0420   0.52308423D 03                                     273  363  0.51D-03
KE0430  I   9  FRANCIS1   0.14537134D 01   0.10908672D-02   0.14505398D 02
KE0430   0.65764941D 03                                     282  303  0.14D-03
KE0500  H   9  FRANCIS1   0.10936251D 01   0.96370699D-03   0.48774409D 00
KE0500   0.42092505D 03   0.56107983D 03                    233  354  0.11D-03
KE0501  H  19  FRANCIS1   0.10943232D 01   0.86304802D-03   0.70360441D 01
KE0501   0.55340259D 03   0.56145996D 03                    273  348  0.66D-04
KE0505  K   3  FRANCIS1   0.10588190D 01   0.84827400D-03   0.00000000D 00
KE0505   0.00000000D 00                                     283  324
KE0510  H  27  FRANCIS1   0.12644968D 01   0.89787156D-03   0.80934544D 01
KE0510   0.61981030D 03                                     277  374  0.20D-03
KE0520  H  15  FRANCIS1   0.12307463D 01   0.95416536D-03   0.36097822D 01
KE0520   0.17891855D 04                                     273  364  0.12D-03
KE0530  I   4  FRANCIS1   0.11695671D 01   0.90240128D-03   0.82282317D 00
KE0530   0.43741748D 03                                     293  361  0.59D-04
KE0540  K   3  FRANCIS1   0.11309113D 01   0.95017100D-03   0.00000000D 00
KE0540   0.00000000D 00                                     293  299
KE0563  K   2  FRANCIS1   0.12291625D 01   0.82216200D-03   0.00000000D 00
KE0563   0.00000000D 00                                     293  299
KE0568  K   2  FRANCIS1   0.14145337D 01   0.11002640D-02   0.00000000D 00
KE0568   0.00000000D 00                                     293  299
KE0600  H   7  FRANCIS1   0.10629501D 01   0.76617324D-03   0.67085629D 01
KE0600   0.54074902D 03   0.58700000D 03                    283  334  0.18D-03
KE0601  I   4  FRANCIS1   0.10622683D 01   0.75031724D-03   0.48805723D 01
KE0601   0.47581445D 03   0.58281982D 03                    297  324  0.14D-04
KE0604  H  18  FRANCIS1   0.10666428D 01   0.82335575D-03   0.69826603D 01
KE0604   0.57530029D 03   0.57100000D 03                    273  374  0.11D-03
KE0607  I  13  FRANCIS1   0.10912037D 01   0.94584492D-03   0.63908215D 01
KE0607   0.12265347D 04   0.56700000D 03                    293  354  0.29D-04
KE0610  K   2  FRANCIS1   0.11699327D 01   0.67871500D-03   0.00000000D 00
KE0610   0.00000000D 00                                     293  299
KE0615  J  21  FRANCIS1   0.12592354D 01   0.73114224D-03   0.24115524D 02
KE0615   0.65499878D 03                                     277  374  0.51D-03
KE0620  H  15  FRANCIS1   0.12110815D 01   0.84087066D-03   0.62623587D 01
KE0620   0.64040259D 03   0.62900000D 03                    273  354  0.49D-04
KE0625  K   3  FRANCIS1   0.11754525D 01   0.89549800D-03   0.00000000D 00
KE0625   0.00000000D 00                                     293  361
KE0650  I   6  FRANCIS1   0.11541748D 01   0.92861406D-03   0.12769001D 02
KE0650   0.83510986D 03                                     293  394  0.43D-04
KE0660  I   4  FRANCIS1   0.15105515D 01   0.97980653D-03   0.19811020D 02
KE0660   0.90835181D 03                                     395  434  0.17D-03
KE0670  I   6  FRANCIS1   0.12066355D 01   0.88522420D-03   0.25476007D 01
KE0670   0.59638232D 03                                     293  394  0.18D-03
```

Table 16. Range 3 liquid density correlations--Continued

KE0700	G 16 FRANCIS1	0.10823164D 01	0.68128319D-03	0.28077332D 02
KE0700	0.71180640D 03	0.61150000D 03		288 429 0.10D-03
KE0701	I 7 FRANCIS1	0.10566082D 01	0.76659396D-03	0.29826403D 01
KE0701	0.51027295D 03			288 360 0.14D-03
KE0702	H 10 FRANCIS1	0.10744505D 01	0.73973392D-03	0.12342205D 02
KE0702	0.59130103D 03			253 394 0.41D-03
KE0720	G 24 FRANCIS1	0.10650043D 01	0.79409732D-03	0.79816027D 01
KE0720	0.59359106D 03			283 374 0.39D-03
KE0725	I 20 FRANCIS1	0.12179537D 01	0.80069271D-03	0.10817964D 02
KE0725	0.63199292D 03			288 374 0.18D-03
KE0730	I 18 FRANCIS1	0.12222862D 01	0.81374589D-03	0.84028273D 01
KE0730	0.60423389D 03			277 374 0.10D-03
KE0735	I 13 FRANCIS1	0.13543797D 01	0.89812255D-03	0.94656706D 01
KE0735	0.10463357D 04			313 374 0.31D-03
KE0740	I 7 FRANCIS1	0.11986494D 01	0.81006484D-03	0.38449039D 01
KE0740	0.65876953D 03			297 374 0.75D-04
KE0745	J 7 FRANCIS1	0.11601934D 01	0.70832646D-03	0.10340004D 02
KE0745	0.66066748D 03			292 357 0.14D-02
KE0746	J 6 FRANCIS1	0.11473150D 01	0.77219424D-03	0.26848648D 02
KE0746	0.44958086D 04			291 361 0.78D-03
KE0747	G 8 FRANCIS1	0.11351528D 01	0.70543634D-03	0.90721703D 00
KE0747	0.37699731D 03			291 360 0.37D-02
KE0760	I 5 FRANCIS1	0.13968458D 01	0.88775204D-03	0.16219463D 01
KE0760	0.61806470D 03			348 401 0.42D-03
KE0800	H 17 FRANCIS1	0.10774565D 01	0.79408265D-03	0.89678802D 01
KE0800	0.64906519D 03			253 434 0.26D-03
KE0801	I 6 FRANCIS1	0.10447025D 01	0.75790938D-03	0.56298885D-01
KE0801	0.37720679D 03			293 360 0.13D-03
KE0802	K 3 FRANCIS1	0.10581158D 01	0.81718800D-03	0.00000000D 00
KE0802	0.00000000D 00			297 324
KE0850	K 2 FRANCIS1	0.10557714D 01	0.85020700D-03	0.00000000D 00
KE0850	0.00000000D 00			293 299
KE0890	I 8 FRANCIS1	0.11752396D 01	0.74465154D-03	0.23469505D 01
KE0890	0.55955298D 03			329 412 0.72D-04
KE0910	K 3 FRANCIS1	0.11457132D 01	0.83233000D-03	0.00000000D 00
KE0910	0.00000000D 00			273 294
KE0930	I 20 FRANCIS1	0.12116728D 01	0.71956799D-03	0.64043417D 01
KE0930	0.51158325D 03			277 374 0.13D-03
KE0950	H 17 FRANCIS1	0.12849731D 01	0.82102115D-03	0.73394318D 01
KE0950	0.74487476D 03			293 475 0.84D-04
KE0980	K 2 FRANCIS1	0.14689927D 01	0.94420500D-03	0.00000000D 00
KE0980	0.00000000D 00			293 299
KE1000	H 16 FRANCIS1	0.10667076D 01	0.69098081D-03	0.18308731D 02
KE1000	0.71997681D 03			298 439 0.74D-04
KE1001	J 4 FRANCIS1	0.10525827D 01	0.76424866D-03	0.19214630D 02
KE1001	0.30584688D 04			293 359 0.25D-02
KE1002	K 3 FRANCIS1	0.10635706D 01	0.82080900D-03	0.00000000D 00
KE1002	0.00000000D 00			297 324
KE1003	H 8 FRANCIS1	0.10534096D 01	0.79098716D-03	0.49999952D-02
KE1003	0.88935620D 03	0.64000000D 03		283 360 0.49D-03
KE1020	I 6 FRANCIS1	0.10386066D 01	0.75689703D-03	0.34747953D 01
KE1020	0.60697998D 03			293 359 0.22D-03

Table 16. Range 3 liquid density correlations--Continued

KE1040	K 2 FRANCIS1	0.10481059D 01	0.76418900D-03	0.00000000D 00
KE1040	0.00000000D 00			293 299
KE1150	I 4 FRANCIS1	0.11017246D 01	0.64413319D-03	0.50127020D 01
KE1150	0.49241553D 03			303 363 0.56D-05
KE1180	I 4 FRANCIS1	0.12283163D 01	0.72272122D-03	0.87706625D 00
KE1180	0.43193555D 03			293 359 0.10D-03
KE1181	I 7 FRANCIS1	0.12354736D 01	0.75112213D-03	0.29371872D 01
KE1181	0.51115088D 03			293 359 0.28D-03
KE1250	I 9 FRANCIS1	0.13698235D 01	0.83868415D-03	0.96535120D 01
KE1250	0.10811353D 04			313 354 0.22D-03
KE1320	K 2 FRANCIS1	0.11775263D 01	0.82878800D-03	0.00000000D 00
KE1320	0.00000000D 00			289 294
KE1350	K 3 FRANCIS1	0.19414714D 01	0.12592340D-02	0.00000000D 00
KE1350	0.00000000D 00			306 347
KE1360	K 3 FRANCIS1	0.14523771D 01	0.95708700D-03	0.00000000D 00
KE1360	0.00000000D 00			292 362
KE1400	K 3 FRANCIS1	0.10606149D 01	0.80690800D-03	0.00000000D 00
KE1400	0.00000000D 00			288 304
KE1401	I 4 FRANCIS1	0.10355082D 01	0.68153860D-03	0.24201708D 01
KE1401	0.52146802D 03			293 359 0.71D-04
KE1403	K 3 FRANCIS1	0.10556330D 01	0.78969400D-03	0.00000000D 00
KE1403	0.00000000D 00			297 324
KE1530	I 7 FRANCIS1	0.11216106D 01	0.75179804D-03	0.11565094D 01
KE1530	0.58048584D 03			273 374 0.47D-04
KE1550	I 5 FRANCIS1	0.11585274D 01	0.88412291D-03	0.99014626D 01
KE1550	0.11632017D 04			287 294 0.14D-04
KE1580	J 6 FRANCIS1	0.11929045D 01	0.71501243D-03	0.31916519D 02
KE1580	0.73905195D 04			291 359 0.76D-03
KE1620	K 3 FRANCIS1	0.12227294D 01	0.85964500D-03	0.00000000D 00
KE1620	0.00000000D 00			453 474
KE1640	K 3 FRANCIS1	0.11054682D 01	0.64550500D-03	0.00000000D 00
KE1640	0.00000000D 00			286 294
KE1660	K 2 FRANCIS1	0.12286730D 01	0.10305550D-02	0.00000000D 00
KE1660	0.00000000D 00			289 294
KE1680	K 2 FRANCIS1	0.12271983D 01	0.10002810D-02	0.00000000D 00
KE1680	0.00000000D 00			288 294
KE1750	I 7 FRANCIS1	0.11910629D 01	0.65790350D-03	0.14866219D 01
KE1750	0.44262402D 03			291 360 0.26D-03
KE1760	I 4 FRANCIS1	0.12143669D 01	0.77111414D-03	0.56137331D-01
KE1760	0.37699731D 03			293 360 0.21D-04
KE1762	I 4 FRANCIS1	0.11962500D 01	0.70684613D-03	0.24943739D 00
KE1762	0.39578760D 03			298 361 0.45D-06
KE1860	I 8 FRANCIS1	0.13859816D 01	0.94468961D-03	0.49999952D-02
KE1860	0.49347217D 03			333 374 0.92D-03
KE2000	I 4 FRANCIS1	0.16353292D 01	0.10515784D-02	0.53056593D 01
KE2000	0.85100244D 03			296 354 0.18D-03
KE2100	G 28 FRANCIS1	0.10617561D 01	0.66399807D-03	0.19551086D 02
KE2100	0.76776074D 03			293 434 0.88D-04
KE2104	I 5 FRANCIS1	0.10162287D 01	0.57980116D-03	0.45092754D 01
KE2104	0.50070825D 03			293 360 0.12D-03
KE2120	I 9 FRANCIS1	0.11690245D 01	0.72760601D-03	0.35297394D 01
KE2120	0.16314060D 04			301 412 0.11D-03

Table 16. Range 3 liquid density correlations--Continued

KE2130	I 4 FRANCIS1	0.12822104D 01	0.88562258D-03	0.85805788D 01
KE2130	0.38810552D 04			289 352 0.20D-03
KE2150	I 9 FRANCIS1	0.12204685D 01	0.79455716D-03	0.14701186D 02
KE2150	0.12922126D 04			292 355 0.11D-03
KE2155	I 4 FRANCIS1	0.12095985D 01	0.79942029D-03	0.79448156D 01
KE2155	0.24433069D 04			293 360 0.24D-03
KE2170	K 2 FRANCIS1	0.12807347D 01	0.86907800D-03	0.00000000D 00
KE2170	0.00000000D 00			287 294
KE2190	K 3 FRANCIS1	0.16299756D 01	0.10330470D-02	0.00000000D 00
KE2190	0.00000000D 00			362 407
KE2225	I 6 FRANCIS1	0.11714888D 01	0.66504418D-03	0.63866241D 02
KE2225	0.22372144D 04			343 416 0.17D-03
KE2235	K 3 FRANCIS1	0.11643365D 01	0.87794400D-03	0.00000000D 00
KE2235	0.00000000D 00			288 294
KE2250	I 8 FRANCIS1	0.11945877D 01	0.78531238D-03	0.15419426D 02
KE2250	0.65498828D 04			299 354 0.13D-03
KE2260	I 4 FRANCIS1	0.13363056D 01	0.72387094D-03	0.21761551D 02
KE2260	0.45346445D 04			293 359 0.26D-03
KE2300	I 14 FRANCIS1	0.10458326D 01	0.69680461D-03	0.47666807D 01
KE2300	0.67093164D 03			303 434 0.28D-04
KE2350	I 4 FRANCIS1	0.11599350D 01	0.66308654D-03	0.26666517D 01
KE2350	0.49937061D 03			294 354 0.12D-03
KE2365	H 16 FRANCIS1	0.13401823D 01	0.75588422D-03	0.45055351D 01
KE2365	0.69762964D 03			328 524 0.21D-03
KE2380	I 4 FRANCIS1	0.13082275D 01	0.72633754D-03	0.51078349D-02
KE2380	0.38099902D 03			293 359 0.23D-04
KE2430	I 7 FRANCIS1	0.14260750D 01	0.73180185D-03	0.32127676D 01
KE2430	0.16007200D 04			403 461 0.72D-03
KE2445	I 4 FRANCIS1	0.12868528D 01	0.70454692D-03	0.12738742D 02
KE2445	0.17073696D 04			293 359 0.38D-03
KE2460	K 2 FRANCIS1	0.15605904D 01	0.87257900D-03	0.00000000D 00
KE2460	0.00000000D 00			565 576
KE2506	K 3 FRANCIS1	0.10552623D 01	0.76081000D-03	0.00000000D 00
KE2506	0.00000000D 00			312 354
KE2540	I 8 FRANCIS1	0.11673403D 01	0.70211850D-03	0.19182373D 02
KE2540	0.99052905D 03			293 354 0.10D-03
KE2565	I 4 FRANCIS1	0.12601871D 01	0.69377758D-03	0.52163324D 01
KE2565	0.12629890D 04			293 359 0.11D-03
KE2630	I 4 FRANCIS1	0.13531923D 01	0.77704038D-03	0.37081345D 02
KE2630	0.17556663D 04			348 407 0.29D-03
KE2645	I 4 FRANCIS1	0.12418633D 01	0.70035667D-03	0.49999952D-02
KE2645	0.80786211D 04			293 359 0.23D-03
KE2680	J 4 FRANCIS1	0.15772915D 01	0.82694599D-03	0.15674782D 03
KE2680	0.31303765D 04			367 427 0.41D-02
KE2685	I 4 FRANCIS1	0.17867718D 01	0.96267578D-03	0.19923569D 02
KE2685	0.15690449D 04			346 409 0.82D-03
KE2688	I 4 FRANCIS1	0.15926456D 01	0.86395908D-03	0.50203278D 02
KE2688	0.44107930D 04			367 423 0.84D-03
KE2707	K 2 FRANCIS1	0.10381524D 01	0.69986300D-03	0.00000000D 00
KE2707	0.00000000D 00			333 354
KE2745	K 3 FRANCIS1	0.13130190D 01	0.71617300D-03	0.00000000D 00
KE2745	0.00000000D 00			391 445

Table 16. Range 3 liquid density correlations--Continued

KE2755	I	4	FRANCIS1	0.12268534D 01	0.67655882D-03	0.18401814D 01				
KE2755	0.69340601D 03					293	359	0.49D-04		
KE2835	I	5	FRANCIS1	0.11383848D 01	0.66913106D-03	0.49246109D 02				
KE2835	0.24330369D 04					319	357	0.15D-03		
KE2845	I	4	FRANCIS1	0.12137480D 01	0.67674927D-03	0.45696878D 01				
KE2845	0.12091201D 04					293	359	0.89D-04		
KE3050	I	5	FRANCIS1	0.11290541D 01	0.66905282D-03	0.51053818D 02				
KE3050	0.27560354D 04					328	355	0.14D-03		
KE3310	K	2	FRANCIS1	0.10338106D 01	0.67308100D-03	0.00000000D 00				
KE3310	0.00000000D 00					343	365			
KE3350	I	5	FRANCIS1	0.11021729D 01	0.68568555D-03	0.27912140D 00				
KE3350	0.60188306D 03					353	574	0.63D-03		
KE3712	K	2	FRANCIS1	0.10227895D 01	0.63346800D-03	0.00000000D 00				
KE3712	0.00000000D 00					353	365			
KE4114	J	5	FRANCIS1	0.10310059D 01	0.64559188D-03	0.19765949D 00				
KE4114	0.75869238D 03					363	574	0.13D-02		
KE4516	K	2	FRANCIS1	0.10552416D 01	0.71184300D-03	0.00000000D 00				
KE4516	0.00000000D 00					361	369			

Table 17. Range 4 liquid density correlations

```
KE0300  H  13  FRANCIS2   0.11984767D-02   0.22339842D 01   0.27800000D 00
KE0300   0.50809985D 03                                    460  508  0.26D-02
```

The last three items are the same as in the vapor pressure tables. The lower and upper temperature limits define the range of the experimental data points actually fitted by the correlation. The rmsd values are much better behaved than for vapor pressure due to the small numerical range covered by the liquid density, and are therefore easier to use in judging the scatter of the data points fitted in a given correlation.

As in the case of vapor pressure, a superficial judging of the quality of a correlation should be based on the quality rating primarily, with the number of points fitted and the rmsd value considered next in that order.

5.4. Second Virial Coefficient

The quality ratings defined in Table 13 are not as useful for the second virial coefficient correlations as for the vapor pressure and liquid density. As explained in section 4.4, the literature data are not screened and no final selected set of data points is fitted to a selected correlation equation. Instead, a curve predicted by each of six predictive equations is "drawn" through all the available literature data sets for each compound. Table 4 shows how well each predictive equation agreed with each literature data set for the various ketones for which second virial coefficient data have been measured. The Tsonopoulos correlation [11414] was chosen for all those compounds except 2-butanone (KE0400) for which the Hayden-O'Connell [8531] correlation appeared to be slightly better.

The parameters for the Tsonopoulos equation for all those ketones with T_c, P_c, acentric factor and dipole moment values are listed in Table 18. The first tier of compounds are those for which experimental B values were available for checking the accuracy level of the Tsonopoulos equation. (See table 4.) The second tier lists compounds for which no experimental B data are available but for which the availability of T_c, P_c, ω and μ values makes possible predictions with the Tsonopoulos equation. Based on the performance of that equation for the compounds in the first tier, there is a good probability that the B values predicted for the second tier of compounds will be close enough to be useful.

The Hayden-O'Connell parameters used for 2-butanone were as follows: T_c = 533.0 K, P_c = 39.50 atm, μ = 2.70 Debye, η = 0.9, R_D = 3.139 °A. These parameters were taken from the Hayden-O-Connell article [8531] and therefore differ in some instances from the values listed for 2-butanone in table 7.

6.0 Equations of State

The uses which can be made of the vapor pressure and liquid density data are severely limited if a reliable equation of state is not available for the compound. Unfortunately, all the equations of state require the availability of T_c and P_c which limits their use to only a few compounds.

Table 18. Parameters used in the Tsonopoulos equation

ID	T_c, K	P_c, atm	ω	a	b
KE0300	508.100	46.390	0.3073	-0.0301	0.0
KE0400	536.780	41.520	0.3220	-0.0228	0.0
KE0500	561.080	36.460	0.3470	-0.0176	0.0
KE0501	561.460	36.800	0.3410	-0.0177	0.0
KE0505	553.400	38.000	0.3301	-0.0195	0.0
KE0601[a]	582.820	32.770	0.3794	-0.0142	0.0
KE0600	587.000	32.795	0.3942	-0.0140	0.0
KE0604[a]	571.000	32.272	0.3663	-0.0150	0.0
KE0607	567.000	34.246	0.3229	-0.0172	0.0
KE0620	629.000	37.997	0.4524	-0.0187	0.0
KE0700	611.500	33.911	0.4857	-0.0127	0.0
KE1003	640.000	22.897	0.5138	-0.00829	0.0

[a]Assumed values of 2.68 for KE0601 and 2.72 for KE0604 were used for the dipole moments.

An attempt is made to store in the pure compound data bank constants for three types of equations of state:

1. Benedict-Webb-Rubin. The original BWR equation [1339], the Sood and Haselden modification [9203], and the Starling modification [1794] can all be used.

2. Redlich-Kwong. The original Redlich-Kwong equation [1454], the Chueh-Prausnitz modification [7541], and the Lu modification [40370] are all supported. The Peng-Robinson equation [40275] is also used and is listed here because of its similarity to the Redlich-Kwong equation.

3. Virial. Space is assigned in the data bank for correlations for both the second and third virial coefficients. Those equations used for B are discussed in section 4.4. Up to the present time, the space for the C correlation has not been used because of the lack of C data and the lack of a reliable correlation equation.

No BWR constants are available for the ketones. Constants are not available for the Chueh-Prausnitz and the Lu modifications of the Redlich-Kwong. Rather than use the unmodified Redlich-Kwong equation for those compounds with T_c and P_c values, the Peng-Robinson equation could be used instead because the acentric factor was also available for all those compounds: KE0300, KE0370, KE0380, KE0400, KE0500, KE0501, KE0505, KE0600, KE0604, KE0607, KE0620, KE0700, KE1003. The T_c, P_c and ω values appear in table 7.

7. Data Tabulations

As a final check on the selected data before it is loaded into the pure compound data bank, program RECVAL is used to produce data tabulations for proofing purposes. When satisfactory tables have been produced for all the compounds, the selected data are loaded into the pure compound data bank where it can be accessed via either interactive or batch programs.

Copies of the RECVAL data tabulations for the 157 ketones for which some storable data were found can be purchased for $200 by sending a check or a purchase order number along with a request for one set of the ketone tables to the Director, Thermodynamics Research Laboratory, Box 1144, Washington University, St. Louis, Missouri 63130. The entire set of ketone tables must be ordered; requests for individual tables will not be processed. A description of a compound table follows.

The first page lists the compound constants available for the compound. Below that tabulation, the values of the conversion constants used to convert the literature data values to the units used in the tables are given. The units used for the tables are kelvin, kilopascals, cubic centimeter/mole and joule/mole.

The tabulations of the temperature-dependent properties are split into the following three temperature intervals,

Interval 1 T_m to $(T_b + 10)$

Interval 2 $(T_b + 5)$ to $(T_c - 40)$

Interval 3 $(T_c - 45)$ to T_c

in order to best utilize the most accurate of the various temperature range fits defined in sections 4.2.3 and 4.3.3. The range fits used for each interval are as follows.

Interval	Property	Range fit
1	vapor pressure	range 2
	liquid density	range 2
2	vapor pressure	range 4
	liquid density	range 3
3	vapor pressure	range 4
	liquid density	range 4

For each interval, the following properties are tabulated at 1.0 K intervals when the necessary information is available: vapor pressure, saturated liquid volume, second virial coefficient, heat of vaporization and saturated vapor volume. Each of the first three requires that a correlation be available and that the specific temperature being listed falls within the range of the correlation being used. If a second virial coefficient correlation is stored

for the compound, a B value will be printed for all temperatures listed because no temperature limits are stored with the correlation equation constants. The heat of vaporization listed is calculated from the Clapeyron equation and listed when vapor pressure and saturated liquid density values are available, and an equation of state is available to provide the saturated vapor molar volume. If an equation of state and the vapor pressure are available, the saturated vapor molar volume will be calculated and listed.

Following the data tabulation for each of the three intervals, the equations used for that interval are printed along with their constants. The temperature limits, the number of data points fitted and the root-mean-squared deviation are given for each vapor pressure and liquid density equation. The second virial coefficient correlation is printed (if one is available) but no temperature limits, number of points, or root-mean-squared-deviation are given. The name of the equation of state used for the interval calculations is given but the equation itself is not printed. The best equation of state for an interval is chosen by program RECVAL by matching a hierarchy of choices against what is available in the compound data files. For the ketones, the virial and/or the Peng-Robinson equations of state were available for those compounds listed in sections 5.4 and 6.0. Equation of state calculations were made only if one or the other of those equations were available; i.e., the ideal gas equation of state was not used as a default.

The last pages of each compound table list the literature reference numbers associated with each property correlation. For the vapor pressure and liquid density correlations, the lists are split into two parts--the documents used and the documents not used for the correlation. A literature document is listed as a "used" document if it contributed at least one data point to the experimental data base upon which the correlation is based. The breakdown between used and not used documents is not necessary for the second virial coefficient correlation.

The used and not used reference numbers appearing at the end of a compound table are those which appear in Table 19 for that compound.

8. References

Table 19 identifies the literature documents which contain data for the various compound-property combinations. The compound is identified in the first column by its identification number. The first letter following that number is the property code--P for vapor pressure, D for liquid density, and B for second virial coefficient. The second is either U for "used" or N for "not used". Those literature documents listed after a U each contributed one data point or more to the selected data base for the correlation. All the data points in documents following an N were excluded from the correlation data base. For each compound, the properties are listed in the order P, B and D. Lines which contain no reference numbers have been deleted in this tabulation. Note that all the literature documents for virial coefficient data follow the U code because those data were not subjected to the selection-deletion process used for the vapor pressure and density.

The citations for the literature documents listed in Table 19 and cited in the text of this report are given in Table 20.

9. Acknowledgements

Financial support for this project was provided by the Office of Standard Reference Data and by the Industrial Participants in the Thermodynamics Research Laboratory.

Table 19. Literature references for individual property correlations

KE0300	P	U	00709	01514	02560	02575	05881	07952	10044	10253	10318	11081	16497
KE0300	P	U	41354	41545	41685								
KE0300	P	N	00041	00129	00130	00189	00196	00202	00219	00340	00721	01284	01348
KE0300	P	N	01359	01361	01578	01638	01674	01683	01780	01803	01826	01880	02242
KE0300	P	N	02422	02478	02595	02673	02894	02899	02920	03087	03855	04423	04455
KE0300	P	N	04637	04743	04839	05000	05030	05067	05143	05182	05901	05981	06035
KE0300	P	N	06102	06104	06106	06108	06111	06115	06119	06482	06765	07073	07127
KE0300	P	N	07140	07406	07510	07948	08672	09546	09767	10037	10131	10165	10358
KE0300	P	N	10586	10763	10830	10841	10968	11019	11097	11364	11373	11410	11857
KE0300	P	N	14102	15362	15518	15521	16587	16683	16911	17538	18048	18275	19402
KE0300	P	N	19439	19951	20019	20137	20426	20469	20484	20711	21878	22903	22906
KE0300	P	N	40067	40207	40217	40642	40979	41162	41522	41586	41759		
KE0300	D	U	00709	00777	01359	02478	05204	09277	10165	11019	15755	40228	
KE0300	D	N	00072	00852	01360	02449	02509	02546	02608	02962	04606	04731	05857
KE0300	D	N	07127	07919	10163	14087	14102	14146	17032	19402	22860	23109	40207
KE0300	D	N	40489	40816									
KE0300	B	U	01257	01803	01950	02422	02678	05214	05283	05948	08330	08577	09027
KE0300	B	U	10972	20469									
KE0305	P	U	40217										
KE0340	D	U	13835										
KE0360	P	U	22644										
KE0360	P	N	07198										
KE0361	P	U	22644										
KE0362	P	U	22644										
KE0370	P	U	10015										
KE0380	P	U	07465	10015	15034	16255	23080						
KE0380	D	U	07465										
KE0380	D	N	10015	15034									
KE0400	P	U	00697	01005	02920	03760	10318	10901	11081				
KE0400	P	N	01146	01361	01780	01880	01882	01985	02560	03209	04418	05030	05067
KE0400	P	N	06128	06763	07162	07439	08193	08971	09712	10834	10998	11017	11130
KE0400	P	N	11162	11178	13138	13799	14102	17059	20484	22466	40936	41379	
KE0400	D	U	00241	01859	02045	02478	02920	03386	04220	06763	07452	09002	09712
KE0400	D	U	10163	11017	11243	12590	14102	15411	20486	40566	40936	41379	
KE0400	D	N	00288	01360	03209	03974	05076	07439	07470	08860	09920	10449	11072
KE0400	D	N	13138	14815	15755	17059	17194	19999	21419	23174	23353	40489	41041
KE0400	B	U	10901	21584									
KE0410	P	U	01732	10537	14792								
KE0410	P	N	15791	19474									
KE0420	P	U	22762	40284									
KE0420	P	N	03383	06237	18654								
KE0420	D	U	03383	06237	40284								
KE0420	D	N	18654										
KE0430	P	U	13997										
KE0430	D	U	13997										
KE0440	P	U	02219	05999	10531	18774							
KE0440	P	N	15628										
KE0445	P	U	11752										

Table 19. Literature references for individual property correlations--Continued

KE0445	P	N	09754								
KE0446	P	U	22770								
KE0450	P	U	14415								
KE0451	P	U	14415								
KE0460	P	U	15556								
KE0500	P	U	04418	05067	10318	10901					
KE0500	P	N	02314	02369	05143	06717	07406	07439	09920	10560	11097	11733	12038
KE0500	P	N	13138	13799	21281	40936					
KE0500	D	U	07439	07470	40489						
KE0500	D	N	02369	02456	05759	07372	07483	07611	09002	09712	09920	10483	10560
KE0500	D	N	11733	12038	13065	13138	15411	20486	40566	40936	41156		
KE0500	B	U	10901								
KE0501	P	U	04033	05067	10318						
KE0501	P	N	00947	01091	01361	03069	03549	04418	05839	06216	07439	07879	10539
KE0501	P	N	11097	11733	21281	22906					
KE0501	D	U	01360	05839	07483	09920	11733	13138	15411	17509	40353	40425	40566
KE0501	D	U	41156								
KE0501	D	N	02856	02894	04220	04269	04703	06216	07439	07449	07470	07879	13065
KE0501	D	N	20615								
KE0501	B	U	04033	21584							
KE0505	P	U	04033	05067	10318						
KE0505	P	N	01091	01361	07406	11733	13799	21601			
KE0505	D	U	01091	21601							
KE0505	D	N	04703	13065	13151						
KE0505	B	U	04033								
KE0510	P	U	15791	16370	41430						
KE0510	P	N	02314	05858	06747	07919	09948	21283			
KE0510	D	U	05858	13839							
KE0510	D	N	02663	03512	06747	13847	15791	16355	22775		
KE0520	P	U	02060	05067	07406	22762	40284				
KE0520	P	N	04670	07948	08193	09754	09923	10472	14204	14453	18654	18956	21047
KE0520	P	N	21283	21545	22760	40156					
KE0520	D	U	00072	02840	04670	07948	18654	18956	40156		
KE0520	D	N	04269	09923	14204	21198	21388				
KE0530	P	U	13292	15758							
KE0530	P	N	05999	08166	14422	15701					
KE0530	D	U	14422								
KE0530	D	N	05999	13292	15701						
KE0540	P	U	01361	23278							
KE0540	P	N	13151								
KE0540	D	U	01360	23270							
KE0540	D	N	05999	10531	15628	18774					
KE0555	P	U	13274								
KE0563	P	U	01361								
KE0563	D	U	01360								
KE0565	P	U	07045								
KE0566	P	U	01146								
KE0568	D	U	22784								
KE0570	P	U	13274								
KE0600	P	U	10318								
KE0600	P	N	02314	07439	09712	11733	12996	13065	13138	13799	21283		

Table 19. Literature references for individual property correlations--Continued

KE0600	D	U	01091	07439	09712	13065						
KE0600	D	N	04703	12996	13138	40489						
KE0601	P	U	04033	10318								
KE0601	P	N	04418	07570	13065	13138	16695	21283				
KE0601	D	U	13065	13138								
KE0601	D	N	07439									
KE0601	B	U	04033									
KE0604	P	U	01091	05067	11773	13065						
KE0604	P	N	00925	01856	03750	06080	07319	08145	08181	08768	09138	11733	13799
KE0604	P	N	15869	17908	19474	22902	23180	40230	40936	41379			
KE0604	D	U	05115	07470	09138	11733	11773	15411	22902	23180	40228	41379	41407
KE0604	D	U	41622										
KE0604	D	N	00925	03699	05876	07439	11233	13065	15869	20519	20529	40936	
KE0605	P	U	08181	13065	15776	21544							
KE0605	P	N	13799										
KE0607	P	U	10318	13065									
KE0607	P	N	05876	07301	07406	08193	10483						
KE0607	D	U	10483										
KE0607	D	N	05876	13065	22773								
KE0610	D	U	03512	16355									
KE0610	D	N	09493	14025									
KE0615	D	U	13839										
KE0620	P	U	01095	03023	04670	10697	18421	18956	19429	40158			
KE0620	P	N	02060	02894	04720	06763	08539	08915	09923	10569	14204	14453	15791
KE0620	P	N	16574	18654	19474	21283	22760	23135	23414	40682			
KE0620	D	U	01529	02840	02894	04670	06763	40158					
KE0620	D	N	02456	04269	04731	09923	11502	14204	15702	15791	18421	18654	18956
KE0620	D	N	21365	23395									
KE0625	D	U	09923										
KE0640	P	U	05067										
KE0640	P	N	22452										
KE0645	P	U	13236										
KE0650	P	U	11773	13236									
KE0650	P	N	03023	04755	10472	14453	20809	21283					
KE0650	D	U	11773										
KE0650	D	N	01176	13236	20809	22408							
KE0660	P	U	20670										
KE0660	D	U	14192										
KE0670	P	U	01146	06962									
KE0670	P	N	05741	09754	11773	12938							
KE0670	D	U	11773										
KE0670	D	N	20707										
KE0680	P	U	22755										
KE0700	P	U	01499	10318									
KE0700	P	N	07439	10483	12038	13065	14905						
KE0700	D	U	09712	10483	12038								
KE0700	D	N	04269	07439	07470	07601	12996	13065	13138	13155	14905	23251	
KE0701	D	U	07601	14417	23251								
KE0701	D	N	13138										
KE0702	P	U	01091	02314	11733	16695							
KE0702	P	N	03549	03760	04220	07439	07601	11735	13138	13155	14649	18394	19474

Table 19. Literature references for individual property correlations--Continued

KE0702	P	N	19842	20779	21544						
KE0702	D	U	07470	11733							
KE0702	D	N	00182	04220	04269	04703	07439	07601	12628	13138	13155	22773	23251
KE0710	P	U	13799										
KE0720	P	U	01361	07406	13799								
KE0720	P	N	03069	08161	08181	10472	10483	13065	13155	14649	19474		
KE0720	D	U	10483	13155									
KE0720	D	N	01360	10472	13065	22773							
KE0725	D	U	00182	13846									
KE0730	D	U	13839										
KE0735	D	U	13839										
KE0740	P	U	18654	40284									
KE0740	P	N	09874	09923	14204	14618	21544						
KE0740	D	U	40284										
KE0740	D	N	09923	18654									
KE0745	D	U	09862	09923	14219								
KE0745	D	N	10707										
KE0746	D	U	09923	14219									
KE0746	D	N	09862	14380									
KE0747	D	U	01990	09862	09923	10707	14219						
KE0747	D	N	14380										
KE0760	D	U	14192										
KE0800	P	U	05842	09712	15791	18439							
KE0800	P	N	05736	05846	07439	07448	12996	18392	18716	19474	21283	21544	
KE0800	D	U	05736	05846	07470	19380	40489						
KE0800	D	N	05842	07439	07449	09712	12996	18439	22773				
KE0801	P	U	13138	14417	18439								
KE0801	P	N	07570										
KE0801	D	U	13138	14417									
KE0801	D	N	18439										
KE0802	P	U	18439										
KE0802	P	N	13138										
KE0802	D	U	13138										
KE0802	D	N	18439										
KE0810	P	U	13799										
KE0830	P	U	13799										
KE0850	P	U	01146										
KE0850	P	N	07301	19474	23310								
KE0850	D	U	21602										
KE0870	P	U	13799										
KE0870	P	N	08193										
KE0890	P	U	40284										
KE0890	P	N	09874	14712	18654								
KE0890	D	U	40284										
KE0910	P	U	09717										
KE0910	D	U	09717										
KE0930	D	U	13846										
KE0950	P	U	01176	02475	04651	05772	10722	11049	18392	20809			
KE0950	P	N	03023	04217	07449	08193	10579	14417	14464	14697	15698	17061	
KE0950	D	U	02475	07372	11049	12707	14417	15698	17061	20809	40489	40688	
KE0950	D	N	00182	04269	04569	07449	13407	13566	19928				

Table 19. Literature references for individual property correlations--Continued

KE0980	P	U	01361				
KE0980	D	U	01360				
KE1000	P	U	05736	12038			
KE1000	P	N	06109	09712	14417		
KE1000	D	U	09712	12038			
KE1000	D	N	05736	14417			
KE1001	D	U	14417				
KE1002	D	U	13138				
KE1003	P	U	10318				
KE1003	P	N	01711	03549	13138	14417	14649
KE1003	D	U	01091	13138	14417		
KE1003	D	N	01631	11733			
KE1020	P	U	05775				
KE1020	P	N	01856	07439	21283		
KE1020	D	U	05775	07439			
KE1020	D	N	41661				
KE1040	D	U	21602				
KE1060	P	U	13799				
KE1100	P	U	18654				
KE1100	P	N	09874				
KE1150	D	U	14195				
KE1150	D	N	20774	22408			
KE1180	P	U	01361	03396	18395		
KE1180	P	N	05988	07288	13438	14417	
KE1180	D	U	14417				
KE1180	D	N	00182	01360	03512	13407	40489
KE1181	D	U	14417	40688	41319		
KE1181	D	N	18601				
KE1200	P	U	06619	14453			
KE1200	P	N	13438	14464	18717	21283	22680
KE1250	D	U	00182				
KE1250	D	N	05988				
KE1320	D	U	06921				
KE1350	D	U	14195				
KE1360	D	U	14195				
KE1400	D	U	09712	21072			
KE1401	D	U	14417				
KE1403	D	U	13138				
KE1403	D	N	07296				
KE1500	P	U	18654				
KE1500	P	N	09874				
KE1530	D	U	13811				
KE1530	D	N	10887	14382			
KE1550	D	U	06837				
KE1580	D	U	09923	14204			
KE1600	P	U	06619				
KE1600	P	N	01856	19474	21283		
KE1620	P	U	21109	21948			
KE1620	P	N	03513	05143	05865		
KE1620	D	U	12455				
KE1640	D	U	06237	20930			

Table 19. Literature references for individual property correlations--Continued

KE1660	D	U	20809					
KE1680	D	U	20809					
KE1700	P	U	06619					
KE1700	P	N	07198	18395	19474			
KE1720	P	U	08739	15685				
KE1750	D	U	05988	14417	40489			
KE1750	D	N	07449	13407				
KE1760	D	U	14417					
KE1762	D	U	14417	40688				
KE1762	D	N	18601					
KE1800	P	U	13305					
KE1820	P	U	10983					
KE1821	P	U	10983					
KE1860	D	U	13839					
KE1900	P	U	11006					
KE1901	P	U	11006					
KE2000	D	U	14195					
KE2100	P	U	10318	12038				
KE2100	P	N	05746	08131	08465	09712	10483	14417 19474
KE2100	D	U	10483	12038				
KE2100	D	N	08465	09712	14417			
KE2104	P	U	10318	13138				
KE2104	P	N	14003	14417	14649	20317		
KE2104	D	U	13138	14417				
KE2104	D	N	22773					
KE2120	P	U	40284					
KE2120	P	N	18654					
KE2120	D	U	40284					
KE2120	D	N	18654					
KE2130	D	U	14195					
KE2150	D	U	06711	13407	40489			
KE2155	D	U	14417					
KE2170	D	U	05988					
KE2190	D	U	14195					
KE2225	P	U	40284					
KE2225	P	N	18654					
KE2225	D	U	40284					
KE2235	D	U	06837					
KE2250	D	U	06711					
KE2250	D	N	13407	18400				
KE2260	D	U	14713					
KE2261	P	U	04651					
KE2300	P	U	10318	12038				
KE2300	P	N	08131	09712				
KE2300	D	U	12038					
KE2300	D	N	09712					
KE2330	P	U	01146	05725	20809			
KE2331	P	U	05725					
KE2350	D	U	06711					
KE2350	D	N	13407					
KE2365	P	U	01361	04651	06664	07481	40222	

Table 19. Literature references for individual property correlations--Continued

KE2365	P	N	05725	08227	15340	15341	15698	17342	19962	20007	20318	20811
KE2365	D	U	00182	20318								
KE2365	D	N	05990	07372	07919	15698						
KE2380	D	U	14713									
KE2430	D	U	14192									
KE2445	D	U	14713									
KE2460	P	U	06817	17342								
KE2460	D	U	20318									
KE2473	P	U	11052									
KE2474	P	U	10550									
KE2477	P	U	10550									
KE2506	P	U	10318									
KE2506	P	N	05736	08131								
KE2506	D	U	14905	19014								
KE2540	D	U	06711									
KE2540	D	N	13407									
KE2545	P	U	13834									
KE2545	P	N	08166									
KE2565	D	U	14713									
KE2630	D	U	14195									
KE2645	D	U	14713									
KE2680	D	U	14195									
KE2685	D	U	14195									
KE2688	D	U	14195									
KE2707	D	U	14905									
KE2745	D	U	14195									
KE2755	D	U	14713									
KE2775	P	U	11052									
KE2835	D	U	06711									
KE2845	D	U	14713									
KE3050	D	U	06711									
KE3310	D	U	19014									
KE3350	P	U	08226									
KE3350	P	N	06753									
KE3350	D	U	08125									
KE3712	D	U	19014									
KE4114	D	U	08125									
KE4114	D	N	19014									

Table 20. Citations for literature documents

41. Campbell, A. N., Kartzmark, E. M., Chatterjee, R. M., Can. J. Chem., 44, 1183 (1966).

72. Loiseleur, H., Merlin, J.-C., Paris, R. A., J. Chim. Phys. Physicochim. Biol., 64, 634 (1967).

129. Haywood, J. K., J. Phys. Chem., 3, 317 (1899).

130. Haywood, J. K., J. Amer. Chem. Soc., 21, 994 (1899).

138. Hubbard, J. C., Phys. Rev., 30, 740 (1910).

145. Krchma, I. J., Williams, J. W., J. Amer. Chem. Soc., 49, 2408 (1927).

182. Perkin, W. H., J. Chem. Soc., London, Trans., 69, 1025 (1896).

189. Rosanoff, M. A., Bacon, C. W., Schulze, J. F. W., J. Amer. Chem. Soc., 36, 1993 (1914).

190. Rosanoff, M. A., Easley, C. W., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 68, 641 (1910).

196. Schmidt, G. C., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 99, 71 (1921).

202. Schulze, A., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 97, 388 (1921).

209. Steinhauser, H. H., White, R. R., Ind. Eng. Chem., 41, 2912 (1949).

218. Trew, V. C. G., Spencer, J. F., Proc. Royal Soc., London, Ser. A, 131, 209 (1931).

219. Tyrer, D., J. Chem. Soc., London, Trans., 101, 1104 (1912).

241. Donald, M. B., Ridgway, K., J. App. Chem., 8, 403 (1958).

288. Jaya Rama Rao, G., Dakshinamurty, P., Venkata Rao, C., J. Sci. Ind. Res., Sect. B, 18, 231 (1959).

295. Sameshima, J., J. Fac. Sci., Imp. Univ. Tokyo, Sect. 1, 1, 63 (1925).

Table 20. Citations for literature documents--Continued

307.	Swami, D. R., Kumarkrishna Rao, V. N., Narasinga Rao, M., Trans., Indian Inst. Chem. Eng., 9(2), 55 (1958).
340.	Zawidzki, J., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 35, 129 (1900).
380.	Ladenburg, A., Kruegel, C., Ber. Deut. Chem. Ges., 33, 637 (1900).
697.	Arm, H., Huegli, F., Signer, R., Helv. Chim. Acta., 40, 1200 (1957).
709.	Brown, I., Smith, F., Aust. J. Chem., 10, 423 (1957).
713.	Brown, I., Fock, W., Aust. J. Chem., 8, 361 (1955).
714.	Brown, I., Smith, F., Aust. J. Chem., 13, 30 (1960).
721.	Byer, S. M., Gibbs, R. E., Van Ness, H. C., AIChE J., 19(2), 245 (1973).
750.	Kyle, B. G., Reed, T. M., III., J. Amer. Chem. Soc., 80, 6170 (1958).
762.	Amaya, K., Bull. Chem. Soc. Jap., 34, 1271 (1961).
777.	Brown, I., Smith, F., Aust. J. Chem., 15, 9 (1962).
838.	Riedel, L., Chem. - Ing. - Tech., 26, 83 (1954).
852.	Winnick, J., Powers, J. E., AIChE J., 12, 460 (1966).
862.	Harris, H. G., Prausnitz, J. M., AIChE J., 14, 737 (1968).
897.	O'Connell, J. P., Prausnitz, J. M., Ind. Eng. Chem., Process Des. Develop., 6, 245 (1967).
925.	Dakshinamurty, P. Jayarama Rao, G., Acharya, M. V. R., Venkata Rao, C., Chem. Eng. Sci., 9, 69 (1958).
947.	Geiseler, G., Jannasch, R., Z. Phys. Chem. (Leipzig), 233, 42 (1966).
1002.	Knoebel, D. H., Edmister, W. C., J. Chem. Eng. Data, 13, 312 (1968).

Table 20. Citations for literature documents--Continued

1005. Swami, D. R., Kumarkrishna Rao, V. N., Narasinga Rao, M., Trans., Indian Inst. Chem. Eng., 9, 47 (1958).

1051. Kudchadker, A. P., Alani, G. H., Zwolinski, B. J., Chem. Rev., 68, 659 (1968).

1091. Rintelen, J. C. Jr., Saylor, J. H., Gross, P. M., J. Amer. Chem. Soc., 59, 1129 (1937).

1095. Glaser, F., Rueland, H., Chem. - Ing. - Tech., 29, 772 (1957).

1146. Stull, D. R., Ind. Eng. Chem., 39, 517 (1947).

1176. Kahlbaum, G. W. A., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 26, 577 (1898).

1257. Lambert, J. D., Roberts, G. A. H., Rowlinson, J. S., Wilkinson, V. J., Proc. Royal Soc., Ser. A, 196, 113 (1949).

1284. Beare, W. G., McVicar, G. A., Ferguson, J. B., J. Phys. Chem., 34, 1310 (1930).

1339. Benedict, M., Webb, G. B., Rubin, L. C., Chem. Eng. Progr., 47, 419 (1951).

1348. Orye, R. V., Prausnitz, J. M., Trans. Faraday Soc., 61, 1338 (1965).

1359. Kretschmer, C. B., Nowakowska, J., Wiebe, R., Ind. Eng. Chem., 38, 506 (1946).

1360. Dreisbach, R. R., Martin, R. A., Ind. Eng. Chem., 41, 2875 (1949).

1361. Dreisbach, R. R., Shrader, S. A., Ind. Eng. Chem., 41, 2879 (1949).

1381. Hudson, J. W., Van Winkle, M., J. Chem. Eng. Data, 14, 310 (1969).

1454. Redlich, O., Kwong, J. N. S., Chem. Rev., 44, 233 (1949).

1499. Stuckey, J. M., Saylor, J. H., J. Amer. Chem. Soc., 62, 2922 (1940).

Table 20. Citations for literature documents--Continued

1511. Babich, S. V., Ivanchikova, R. A., Serafimov, L. A., J. Applied Chem. (Leningrad), 42, 1275 (1969).

1514. Bekarek, V., Hala, E., Collect. Czech. Chem. Commun., 33, 2598 (1968).

1529. Diaz Pena, M., Haya, M., An. Real Soc. Espan. Fis. Quim., Ser. B, 60, 423 (1964).

1535. Thacker, R., Rowlinson, J. S., Trans. Faraday Soc., 50, 1036 (1954).

1578. Amer, H. H., Paxton, R. R., Van Winkle, M., Ind. Eng. Chem., 48, 142 (1956).

1631. Renon, H., Prausnitz, J. M., Ind. Eng. Chem., Process Des. Develop., 7, 220 (1968).

1638. Radulescu, D., Alexa, M., Soc. Chim. Romania, Bucharest, 20, 89 (1938).

1670. Rosanoff, M. A., Bacon, C. W., White, R. H., J. Amer. Chem. Soc., 36, 1803 (1914).

1674. Prentiss, S. W., J. Amer. Chem. Soc., 51, 2825 (1929).

1683. Othmer, D. F., Morley, F. R., Ind. Eng. Chem., 38, 751 (1946).

1706. Thompson, W. H., Ph.D. Dissertation, Pennsylvania State University, University Park, Pa., 1966.

1711. Renon, H. M., Ph.D. Dissertation, University of California, Berkeley, Calif., 1966.

1732. Orye, R. V., Ph.D. Dissertation, University of California, Berkeley, Calif., 1965.

1780. Othmer, D. F., Benenati, R. F., Ind. Eng. Chem., 37, 299 (1945).

1794. Cox, K. W., Bono, J. L., Kwok, Y. C., Starling, K. E., Ind. Eng. Chem., Fundam., 10, 245 (1971).

1803. Hajjar, R. F., Kay, W. B., Leverett, G. F., J. Chem. Eng. Data, 14, 377 (1969).

Table 20. Citations for literature documents--Continued

1821. Freshwater, D. C., Pike, K. A., J. Chem. Eng. Data, 12, 179 (1967).

1826. Bachman, K. C., Simons, E. L., Ind. Eng. Chem., 44, 202 (1952).

1856. Othmer, D. F., Ind. Eng. Chem., 35, 614 (1943).

1859. Amick, E. H., Jr., Weiss, M. A., Kirshenbaum, M. S., Ind. Eng. Chem., 43, 969 (1951).

1880. Othmer, D. F., Chudgar, M. M., Levy, S. L., Ind. Eng. Chem., 44, 1872 (1952).

1882. Fowler, R. T., Norris, G. S., J. App. Chem., 5, 266 (1955).

1950. Kappallo, W., Lund, N., Schaefer, K., Z. Phys. Chem. (Frankfurt am Main), 37, 196 (1963).

1985. Hanson, D. O., Ph.D. Dissertation, The University of Texas, Austin, Texas, 1966.

1990. Heric, E. L., Brewer, J. G., J. Chem. Eng. Data, 12, 574 (1967).

2045. Krishnamurty, V. V. G., Venkata Rao, C., J. Sci. Ind. Res., Sect. B, 14, 55 (1955).

2060. Conn, J. B., Kistiakowsky, G. B., Smith, E. A., J. Amer. Chem. Soc., 61, 1868 (1939).

2133. Kay, W. B., J. Phys. Chem., 68, 827 (1964).

2219. Jakubicek, J., Collect. Czech. Chem. Commun., 26, 300 (1961).

2242. Hannaert, H., Haccuria, M., Mathieu, M. P., Ind. Chim. Belge., 32, 156 (1967).

2314. Timmermans, J., Bull, Soc. Chim. Belg., 30, 62 (1921).

2369. Pomerantz, P., Fookson, A., Mears, T. W., Rothberg, S., Howard, F. L., J. Res. Nat. Bur. Stand., 52, 59 (1954).

2372. Frost, A. A., Kalkwarf, D. R., J. Chem. Phys., 21, 264 (1953).

Table 20. Citations for literature documents--Continued

2422. Zaalishvili, Sh. D., Belousova, Z. S., Russ. J. Phys. Chem., 38, 269 (1964).

2449. Ling, T. D., Van Winkle, M., Chem. Eng. Data Ser., 3, 88 (1958).

2456. Tomonari, T., Z. Phys. Chem., Abt. B, 32, 202 (1936).

2475. Timmermans, J., Hennaut-Roland, Mm., J. Chim. Phys. Physicochim. Biol., 32, 501 (1935).

2478. Timmermans, J., Martin, F., J. Chim. Phys. Physicochim. Biol., 25, 411 (1928).

2479. Timmermans, J., Martin, F., J. Chim. Phys. Physicochim. Biol., 23, 733 (1926).

2509. Yergovich, T. W., Swift, G. W., Kurata, F., J. Chem. Eng. Data, 16, 222 (1971).

2546. Kelley, K. K., J. Amer. Chem. Soc., 51, 1145 (1929).

2560. Brunel, R. F., J. Amer. Chem. Soc., 45, 1334 (1923).

2575. Gordon, A. R., Hines, W. G., Can. J. Res., Sect. B, 24, 254 (1946).

2595. Campbell, F. H., Trans. Faraday Soc., 11, 91 (1915).

2608. Herz, W., Neukirch, E., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 104, 433 (1923).

2663. Jaeger, F. M., Kahn, J., J. Chem. Soc., London, 108(II), 747 (1915).

2673. Weissenberger, G., Henke, R., Katschinka, H., Z. Anorg. Allg. Chem., 153, 33 (1926).

2674. Parks, G. S., Kelley, K. K., J. Amer. Chem. Soc., 47, 2089 (1925).

2678. Bottomley, G. A., Spurling, T. H., Aust. J. Chem., 20, 1789 (1967).

Table 20. Citations for literature documents--Continued

2763. Coomber, D. I., Partington, J. R., J. Chem. Soc., London, 1444 (1938).

2839. Lo, T. C., Bieber, H. H., Karr, A. E., J. Chem. Eng. Data, 7, 327 (1962).

2840. Kuss, E., Z. Angew. Phys., 7, 372 (1955).

2856. Schwers, F., Rec. Trav. Chim. Pays-Bas Belg., 28, 42 (1909).

2894. Richards, T. W., Shipley, J. W., J. Amer. Chem. Soc., 38, 989 (1916).

2899. Roland, M., Bull, Soc. Chim. Belg., 37, 117 (1928).

2908. Zilberman-Granovskaya, A. A., Zh. Fiz. Khim., 14, 759 (1940).

2920. Timmermans, J., Bull, Soc. Chim. Belg., 24, 244 (1910).

2929. Uchida, S.-i., Ogawa, S., Hirata, M., Shimada, G., Shimokawa, S., Takebayashi, H., Hoshida, Y., Kagaku Kogaku, 17, 190 (1953).

2962. Stern, O., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 81, 441 (1913).

3023. Lecat, M., Rec. Trav. Chim. Pays-Bas, 45, 620 (1926).

3069. Maess, L., Mueffling, L., Angew. Chem., 50, 759 (1937).

3087. Tonomura, T., Sci. Rep. Tohoku Univ., Ser. 1 (Ph. Ch. A.), 22, 104 (1933).

3163. Douglas, T. B., J. Res. Nat. Bur. Stand., Sect. A, 73(5), 451 (1969).

3209. Felsing, W. A., Shofner, L., Garlock, N. B., J. Amer. Chem. Soc., 56, 2252 (1934).

3222. Kell, G. S., J. Chem. Eng. Data, 12, 66 (1967).

3270. Zwolinski, B. J., Editor, "Selected Values of Properties of Chemical Compounds," Thermodynamics Research Center, Texas A & M University, College Station, Texas, 1969.

Table 20. Citations for literature documents--Continued

3375. Kobe, K. A., Lynn, R. E., Jr., Chem. Rev., 52, 117 (1953).

3382. Onken, U., Z. Phys. Chem. (Frankfurt am Main), 33, 162 (1962).

3383. Timmermans, M. J., Hennaut-Roland, J. Chim. Phys. Physicochim. Biol., 56, 984 (1959).

3386. Raja Rao, M., Venkata Rao, C., J. App. Chem., 7, 659 (1957).

3396. Lecat, M., Ann. Soc. Sci. Bruxelles, Ser. 20 N. M., 45, 284 (1926).

3414. Venkataratnam, A., Jagannadha Rao, R., Venkata Rao, C., Chem. Eng. Sci., 7, 102 (1957).

3465. Redfield, H. L., King, G. B., J. Phys. Chem., 40, 919 (1936).

3512. Schaaffs, W., Z. Phys. Chem. (Leipzig), 194, 28 (1944).

3513. Lecat, M., C. R. Acad. Sci., 217, 242 (1943).

3549. Timmermans, J., Bull, Soc. Chim. Belg., 36, 502 (1927).

3550. Sapgir, S., Bull, Soc. Chim. Belg., 38, 392 (1929).

3584. Howard, K. S., Pike, F. P., J. Chem. Eng. Data, 4, 331 (1959).

3699. Rama Murty, M., Raja Rao, M., Venkata Rao, C., J. Sci. Ind. Res., Sect. B, 17, 103 (1958).

3732. Desvergnes, L., Ann. Chim. Anal. Chim. Appl. R., 10, 226 (1928).

3739. Nagata, I., Kanazawa Daigaku Kogakubu Kiyo, 3(3), 197 (1964).

3750. Ramanarao, M. V., Husain, A., Chari, K. S., Indian J. Technol., 2(8), 252 (1964).

3760. Lecat, M., Ann. Soc. Sci. Bruxelles, Ser. 20 N. M., 50, 21 (1930).

3817. Levichev, S. A., Fiz.-Khim. Svoistva Rastvorov, 219 (1964).

3855. Hirth, L. J., Harris, H. G., Prausnitz, J. M., AIChE J., 14(5), 812 (1968).

Table 20. Citations for literature documents--Continued

3899. Gorbunova, L. V., Lutugina, N. V., Malenko, Yu. I., Zh. Prikl. Khim. (Leningrad), 38(2), 374 (1965).

3974. Lutskii, A. E., Obukhova, E. M., Sidorov, I. A., J. Gen. Chem. USSR, 28, 2423 (1958).

4033. Hales, J. L., Lees, E. B., Ruxton, D. J., Trans. Faraday Soc., 63(8), 1876 (1967).

4036. Timmermans, J., Naveau, J., Bull, Soc. Chim. Belg., 67, 560 (1958).

4094. Francis, A. W., Ind. Eng. Chem., Prod. Res. Develop., 49(10), 1779 (1957).

4121. Rackett, H. G., J. Chem. Eng. Data, 15, 514 (1970).

4123. Spencer, C. F., Danner, R. P., J. Chem. Eng. Data, 17, 236 (1972).

4217. Lesteva, T. M., Kachalova, R. V., Morozova, A. I., Ogorodnikov, S. K., Trenke, K. M., J. Appl. Chem. USSR, 40(8), 1738 (1967).

4220. Maripuri, V. C., Ratcliff, G. A., J. App. Chem. Biotechnol., 22, 899 (1972).

4267. Timmermans, J., Bull, Soc. Chim. Belg., 25, 300 (1911).

4269. Soczewinski, E., Wolski, T., Przem. Chem., 45(5), 254 (1966).

4288. Timmermans, J., Bull, Soc. Chim. Belg., 61, 393 (1952).

4350. Danciu, E., Rev. Chim. (Bucharest), 22(2), 81 (1971).

4418. Collerson, R. R., Counsell, J. F., Handley, R., Martin, J. F., Sprake, C. H. S., J. Chem. Soc., London, 3697 (1965).

4423. Drucker, C., Jimeno, E., Kangro, W., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 90(5), 513 (1915).

4455. Jose, J., Philippe, R., Clechet, P., Bull. Soc. Chim. Fr., (8), 2860 (1971).

4529. Miller, D. G., Ind. Eng. Chem., 56, 46 (1964).

Table 20. Citations for literature documents--Continued

4565. Deshpande, D. D., Bhatgadde, L. G., Aust. J. Chem., 24, 1817 (1971).

4569. Kendall, J., Brakeley, E., J. Amer. Chem. Soc., 43, 1826 (1921).

4606. Timmermans, J., Bull, Soc. Chim. Belg., 26, 205 (1912).

4633. Fischer, R., Reichel, T., Mikrochemie, 31, 102 (1943).

4637. Sameshima, J., J. Amer. Chem. Soc., 40, 1482 (1918).

4651. Nowak, G. A., Seifen, Oele, Fette, Wachse, 87(13), 405 (1961).

4670. Timmermans, M. J., Hennaut-Roland, Mme., J. Chim. Phys. Physicochim. Biol., 34, 693 (1937).

4703. Gartenmeister, R., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 6, 524 (1890).

4706. Burkhead, R. J., M.S. Thesis, University of Kentucky, Lexington, Kentucky, 1971.

4720. De Mol, A., Ing. Chim. (Brussels), 22, 262 (1938).

4731. Philip, N. M., Proc. Indian Acad. Sci., Sect. A, 9, 109 (1939).

4743. Gil, E. J., An. Quim., 12, 469 (1914).

4755. Kahlbaum, G. W. A., Ber. Deut. Chem. Ges., 17, 1245 (1884).

4839. Costanares, A. P., An. Inst. Med. Nac., 2, 75 (1911).

5000. Soday, F. J., Bennett, G. W., J. Chem. Educ., 7, 1336 (1930).

5009. Hakuta, T., Suda, S., Hirata, M., Mem. Fac. Technol., Tokyo Metrop. Univ., (20), 1819 (1970).

5030. Nagahama, K., Suda, S., Hakuta, T., Hirata, M., Sekiyu Gakkai Shi, 14, 252 (1971).

5067. Kobe, K. A., Crawford, H. R., Stephenson, R. W., Ind. Eng. Chem., 47, 1767 (1955).

Table 20. Citations for literature documents--Continued

5076. Kumarkrishna Rao, V. N., Swami, D. R., Narasinga Rao, M., J. Sci. Ind. Res., Sect. B, 16 195 (1957).

5103. Geiseler, G., Quitzsch, K., Vogel, H.-G., Pilz, D., Sachse, H., Z. Phys. Chem. (Frankfurt am Main), 56, 288 (1967).

5115. Linek, J., Wichterle, I., Collect. Czech. Chem. Commun., 38(7), 1846 (1973).

5143. Beckmann, E., Fuchs, G., Gernhardt, V., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 18, 473 (1895).

5182. Kudryavtseva, L. S., Susarev, M. P., J. Appl. Chem. USSR, 36, 1419 (1963).

5204. Timmermans, J., Sci. Proc. R. Dublin Soc., 13, 310 (1912).

5214. Zaalishvili, Sh. D., Kolysko, L. E., Russ. J. Phys. Chem., 34, 1223 (1960).

5249. Howard, K. S., Pike, F. P., J. Chem. Eng. Data, 4(4), 331 (1959).

5266. McClellan, A. L., Tables of Experimental Dipole Moments. W. H. Freeman & Company, San Francisco, Calif., 1963.

5283. Abbott, M. M., Ph.D. Dissertation, Rensselaer Polytechnic Institute, Troy, New York, 1965.

5367. Parks, G. S., Kennedy, W. D., Gates, R. R., Mosley, J. R., Moore, G. E., Renquist, M. L., J. Amer. Chem. Soc., 78, 56 (1956).

5371. Dilke, M. H., Eley, D. D., Sheppard, M. G., Trans. Faraday Soc., 46, 261 (1950).

5383. Serpinskii, V. V., Voitkevich, S. A., Lyuboshits, N. Yu., Zh. Fiz. Khim., 28, 1969 (1954).

5394. Lutugina, N. V., Pukinsky, I. B., Kaliev, S. G., Vestn. Leningrad. Univ., Fiz. Khim., 4(22), 102 (1972).

5725. Serpinskii, V. V., Voitkevich, S. A., Lyuboshits, N. Yu., Tr. Vses. Nauch. Issled. Inst. Sin. Natur. Dushistykh Veshchestv, (4), 125 (1958).

Table 20. Citations for literature documents--Continued

5736. Deffet, L., Bull, Soc. Chim. Belg., 40, 385 (1931).

5741. Updike, O. L., Jr., Langdon, W. M., Keyes, D. B., Trans. Amer. Inst. Chem. Eng., 41, 717 (1945).

5746. Timmermans, J., Bull. Soc. Chim. Belg., 31, 389 (1922).

5759. Perkin, W. H., J. Chem. Soc., London, 45, 421 (1884).

5772. Grimm, F. V., Patrick, W. A., J. Amer. Chem. Soc., 45, 2794 (1923).

5775. Stross, F. H., Gable, C. M., Rounds, G. C., J. Amer. Chem. Soc., 69, 1629 (1947).

5839. Timmermans, M. J., Hennaut-Roland, Mme., J. Chim. Phys. Physicochim. Biol., 29, 529 (1932).

5842. Bruhl, J. W., Justus Liebigs Ann. Chem., 203, 9 (1880).

5846. Falk, K. G., J. Amer. Chem. Soc., 31, 806 (1909).

5857. Faust, O., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 79, 97 (1912).

5858. Falk, K. G., J. Amer. Chem. Soc., 31, 86 (1909).

5865. Ramsey, W., Young, S., Philos. Trans. R. Soc. London, 175, 461 (1884).

5869. Deffet, L., Bull, Soc. Chim. Belg., 44, 41 (1935).

5876. Geiseler, G., Quitzsch, K., Hofmann, H.-P., Pfestorf, R., Z. Phys. Chem. (Leipzig), 252, 170 (1973).

5881. Sassa, Y., Konishi, R., Katayama, T., J. Chem. Eng. Data, 19, 44 (1974).

5901. Francesconi, R., Comelli, F., Canepa, B., Chim. Ind. (Milan), 56, 485 (1974).

5922. Linek, J., Wichterle, I., Collect. Czech. Chem. Commun., 38(7), 1846 (1973).

Table 20. Citations for literature documents--Continued

5948. Knoebel, D. H., Ph.D. Dissertation, Oklahoma State University, Stillwater, Oklahoma, 1967.

5981. Regnault, M. V., C. R. Acad. Sci., 50, 1063 (1860).

5988. von Auwers, K., Justus Liebigs Ann. Chem., 415, 98 (1917).

5990. Walden, P., Swinne, R., Z. Phys. Chem. (Leipzig), 79, 700 (1912).

5999. Rogers, M. T., J. Amer. Chem. Soc., 69, 2544 (1947).

6035. Sajotschewsky, W., Beibl. Ann. Phys., 3, 741 (1879).

6080. Hill, W. D., Van Winkle, M., Ind. Eng. Chem., 44(1), 208 (1952).

6102. Marshall, A., J. Chem. Soc., London, Trans., 89, 1350 (1906).

6104. Carveth, H. R., J. Phys. Chem., 3, 193 (1899).

6106. Taylor, A. E., J. Phys. Chem., 4, 355 (1900).

6108. Morton, D. S., J. Phys. Chem., 33, 384 (1929).

6109. Hoerr, C. W., Reck, R. A., Corcoran, G. B., Harwood, H. J., J. Phys. Chem., 59, 457 (1955).

6110. Hellwig, L. R., Van Winkle, M., Ind. Eng. Chem., 45, 624 (1953).

6111. Fordyce, C. R., Simonsen, D. R., Ind. Eng. Chem., 41, 104 (1949).

6115. Schreinemakers, F. A. H., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 39, 485 (1902).

6119. Kuenen, J. P., Robson, W. G., Phil. Mag., 4, 116 (1902).

6128. Newman, M., Hayworth, C. B., Treybal, R. E., Ind. Eng. Chem., 41, 2039 (1949).

6133. Uchida, S., Ogawa, S., Yamaguchi, M., Japan Sci. Rev., Eng. Sci., 1(2), 41 (1950).

Table 20. Citations for literature documents--Continued

6216. Haddad, P. O., Ph.D. Dissertation, Oklahoma State University, Stillwater, Oklahoma, 1972.

6237. Ostling, G. J., J. Chem. Soc., London, 101, 457 (1912).

6288. Pitzer, K. S., Curl, R. F., Jr., J. Amer. Chem. Soc., 79, 2369 (1957).

6376. Brown, I., Smith, F., Aust. J. Chem., 10, 423 (1957).

6482. Mathews, J. H., J. Amer. Chem. Soc., 48, 562 (1926).

6486. Mathews, J. H., Fehlandt, P. R., J. Amer. Chem. Soc., 53, 3212 (1931).

6614. Ubbelohde, A. R., Trans. Faraday Soc., 34, 282 (1938).

6619. Kobe, K. A., Okabe, T. S., Ramstad, M. T., Huemmer, P. M., J. Amer. Chem. Soc., 63, 3251 (1941).

6651. Whitmore, F. C., Sutherland, L. H., Cosby, J. N., J. Amer. Chem. Soc., 64, 1360 (1942).

6664. Finck, J. L., Wilhelm, R. M., J. Amer. Chem. Soc., 47, 1577 (1925).

6711. Ju, T. Y., Shen, G., Wood, C. E., J. Inst. Petrol., London, 26, 514 (1940).

6717. Sisskind, B., Kasarnowsky, I., Z. Anorg. Allg. Chem., 214, 385 (1933).

6747. Melia, T. P., Merrifield, R., J. Appl. Chem., 19, 79 (1969).

6753. Krafft, F., Ber. Deut. Chem. Ges., 19, 2982 (1886).

6763. Sokolova, E. P., Morachevskii, A. G., Vestn. Leningrad. Univ., Fiz. Khim., 22(22), 98 (1967).

6765. Sokolova, E. P., Morachevskii, A. G., Vestn. Leningrad. Univ., Fiz. Khim., 22(16), 110 (1967).

6766. Belousov, V. P., Sokolova, E. P., Vestn. Leningrad. Univ., Fiz. Khim., 21(16), 90 (1966).

Table 20. Citations for literature documents--Continued

6771. Kreglewski, A., J. Phys. Chem., 73, 608 (1969).

6817. Nelson, O. A., Senseman, C. E., Ind. Eng. Chem., 14, 58 (1922).

6837. Auwers, K., Lange, E., Justus Liebigs Ann. Chem., 409, 149 (1915).

6885. Kroeger, J. W., Sowa, F. J., Nieuwland, J. A., J. Org. Chem., 1, 163 (1936).

6921. Kizhner, N., Zh. Russ. Fiz. - Khim. Obshchest, Chast Khim. 45, 957 (1913).

6945. Krafft, F., Ber. Deut. Chem. Ges., 15, 1711 (1882).

6962. Hack, C. W., Van Winkle, M., Ind. Eng. Chem., 46(11), 2392 (1954).

6966. Jones, J. H., McCants, J. F., Ind. Eng. Chem., 46(9), 1956 (1954).

7029. Othmer, D. F., Savitt, S. A., Krasner, A., Goldberg, A. M., Markowitz, D., Ind. Eng. Chem., 41(3), 572 (1949).

7045. Conner, A. Z., Elving, P. J., Benischeck, J., Tobias, P. E., Steingiser, S., Ind. Eng. Chem., 42(1), 106 (1950).

7051. Clegg, J. W., Bearse, A. E., Ind. Eng. Chem., 42(6), 1222 (1950).

7064. Alpert, N., Elving, P. J., Ind. Eng. Chem., 43(5), 1182 (1951).

7073. Brown, C. H., M.S. Thesis, Ohio State University, Columbus, Ohio, 1959.

7127. Felsing, W. A., Durban, S. A., J. Amer. Chem. Soc., 48, 2885 (1926).

7140. Archibald, E. H., Ure, W., Trans. Roy. Soc. Can., Sect. 3, 21, 133 (1927).

7162. Meissner, H. P., Stokes, C. A., Ind. Eng. Chem., 36(9), 816 (1944).

Table 20. Citations for literature documents--Continued

7169. Boese, A. B., Jr., Ind. Eng. Chem., 32(1), 16 (1940).

7187. Young, S., J. Chem. Soc., London, Trans., 59, 621 (1891).

7198. Lecat, M., Ann. Soc. Sci. Bruxelles, Ser. B, 47, 108 (1927).

7203. Skvortsova, O. V., Chashchin, A. M., Serafimov, L. A., Gidroliz. Lesokhim. Prom., (5), 10 (1973).

7240. Dinaburg, M. S., Porai-Koshits, B. A., J. Appl. Chem. USSR, 28, 517 (1955).

7286. Barnett, E. DeB., Sanders, F. G., J. Chem. Soc., London, 434 (1933).

7288. Baddeley, G., Kenner, J., J. Chem. Soc., London, 303 (1935).

7290. Badger, G. M., Cook, J. W., Goulden, F., J. Chem. Soc., London, 16 (1940).

7296. Bried, E. A., Hennion, G. F., J. Amer. Chem. Soc., 60, 1717 (1938).

7301. Whitmore, F. C., Laughlin, K. C., J. Amer. Chem. Soc., 55, 3732 (1933).

7304. Bradsher, C. K., J. Amer. Chem. Soc., 62, 486 (1940).

7319. Clarke, L., Shreve, R. N., Amer. Chem. J., 35, 513 (1906).

7358. Norris, J. F., Green, E. H., Amer. Chem. J., 26, 293 (1901).

7372. Livingston, J., Morgan, R., Stone, E. C., J. Amer. Chem. Soc., 35, 1505 (1913).

7373. Barnett, E. DeB., Goodway, N. F., J. Chem. Soc., London, 1754 (1929).

7406. Baughan, E. C., Jones, A. L., Stewart, K., Proc. Royal Soc. London, Ser. A, 225, 478 (1954).

7424. Bailey, A. S., Polgar, N., Robinson, R., J. Chem. Soc., London, 3031 (1953).

Table 20. Citations for literature documents--Continued

7428. Churchward, V. R., Gibson, N. A., Meakins, R. J., Mulley, J. W., J. Chem. Soc., London, 959 (1950).

7431. Cymerman, J., Heilbron, I. M., Jones, E. R. H., J. Chem. Soc., London, 90 (1945).

7434. Catch, J. R., Hey, D. H., Jones, E. R. H., Wilson, W., J. Chem. Soc., London, 276 (1948).

7439. Cowan, D. M., Jeffery, G. H., Vogel, A. I., J. Chem. Soc., London, 171 (1940).

7440. Birch, A. J., Robinson, R., J. Chem. Soc., London, 488 (1942).

7448. Beattie, I. R., Bell, S. W., Vosper, A. J., J. Chem. Soc., London, 4796 (1960).

7449. Carswell, H. E., Adkins, H., J. Amer. Chem. Soc., 50, 235 (1928).

7452. Campbell, A. N., Kartzmark, E. M., Falconer, W. E., Can. J. Chem., 36, 1475 (1958).

7455. Crawford, M., Little, W. T., J. Chem. Soc., London, 729 (1959).

7465. Mousa, A. El H. N., Kay, W. B., Kreglewski, A., J. Chem. Thermodyn., 4, 301 (1972).

7470. Cole, R. H., J. Chem. Phys., 9, 251 (1941).

7481. Crafts, J.-M., J. Chim. Phys. Physicochim. Biol., 13, 105 (1915).

7483. Chancel, G., C. R. Acad. Sci., 99, 1053 (1884).

7489. Bailey, W. J., Daly, J. J., Jr., J. Org. Chem., 22, 1189 (1957).

7493. de Benneville, P. L., J. Org. Chem., 6, 462 (1941).

7494. Clement, W. H., Selwitz, C. M., J. Org. Chem., 29, 241 (1964).

7501. Cason, J., Wolfhagen, H. J., Tarpey, W., Adams, R. E., J. Org. Chem., 14, 147 (1949).

Table 20. Citations for literature documents--Continued

7505. Dakin, H. D., Amer. Chem. J., 44, 41 (1910).

7508. Clarke, L., Amer. Chem. J., 39, 572 (1908).

7509. Clarke, L., Amer. Chem. J., 39, 87 (1908).

7510. Tallmadge, J. A., Canjar, L. N., Ind. Eng. Chem., 46(6), 1279 (1954).

7541. Chueh, P. L., Prausnitz, J. M., Ind. Eng. Chem., Fundam., 6(4), 492 (1967).

7562. Ernst, R. C., Litkenhous, E. E., Spanyer, J. W. Jr., J. Phys. Chem., 36, 842 (1932).

7567. Parks, G. S., Kelley, K. K., J. Amer. Chem. Soc., 47, 2089 (1925).

7570. Pickard, R. H., Kenyon, J., J. Chem. Soc., London, 103, 1923 (1913).

7579. Tyrer, D., J. Chem. Soc., London, Trans., 101, 1104 (1912).

7596. Dorough, G. L., Glass, H. B., Gresham, T. L., Malone, G. B., Reid, E. E., J. Amer. Chem. Soc., 63, 3100 (1941).

7601. Sherrill, M. L., J. Amer. Chem. Soc., 52, 1982 (1930).

7611. Ramsay, W., Shields, J., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 12, 433 (1893).

7625. Timmermans, M. J., Hennaut-Roland, J. Chim. Phys. Physicochim. Biol., 29, 529 (1932).

7854. Marinichev, A. N., Susarev, M. P., Russ. J. Phys. Chem., 43(5), 631 (1969).

7879. Geiseler, G., Kohler, H., Ber. Bunsenges. Phys. Chem., 72(6), 697 (1968).

7903. von Zawidzki, J., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 35, 129 (1900).

7919. Walden, P., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 70, 569 (1910).

Table 20. Citations for literature documents--Continued

7948. Loiseleur, H., Merlin, J. C., Paris, R. A., J. Chim. Phys. Physicochim. Biol., 61, 1231 (1964).

7952. Zmaczynski, A., J. Chim. Phys. Physicochim. Biol., 27, 503 (1930).

8125. Boelhouwer, J. W. M., Nederbragt, G. W., Verberg, G., App. Sci. Res., Sect. A, 2, 249 (1950).

8131. Dreger, E. E., Keim, G. I., Miles, G. D., Shedlovsky, L., Ross, J., Ind. Eng. Chem., 36, 610 (1944).

8145. Ballard, L. H., Van Winkle, M., Ind. Eng. Chem., 45, 1803 (1953).

8148. Clarke, L., Riegel, E. R., J. Amer. Chem. Soc., 34, 674 (1912).

8150. Clarke, L., J. Amer. Chem. Soc., 31, 585 (1909).

8151. Clarke, L., J. Amer. Chem. Soc., 30, 1144 (1908).

8152. Djerassi, C., Geller, L. E., J. Amer. Chem. Soc., 81, 2789 (1959).

8160. Brown, H. C., Nakagawa, M., J. Amer. Chem. Soc., 77, 3614 (1955).

8161. Bartlett, P. D., Stiles, M., J. Amer. Chem. Soc., 77, 2806 (1955).

8166. Elderfield, R. C., McCarthy, J. R., J. Amer. Chem. Soc., 73, 975 (1951).

8167. Clarke, L., J. Amer. Chem. Soc., 34, 680 (1912).

8177. Drake, N. L., Veitch, F. P., Jr., J. Amer. Chem. Soc., 57, 2623 (1935).

8180. Erickson, J. L. E., Barnett, M. M., J. Amer. Chem. Soc., 57, 560 (1935).

8181. Bryant, W. M. D., Smith, D. M., J. Amer. Chem. Soc., 57, 57 (1935).

Table 20. Citations for literature documents--Continued

8193. Baker, R. H., Adkins, H., J. Amer. Chem. Soc., 62, 3305 (1940).

8208. Bramley, A., J. Chem. Soc., London, Trans., 109, 434 (1916).

8210. Davies, W. C., Dixon, R. S., Jones, W. J., J. Chem. Soc., London, 468 (1930).

8215. Baker, F., J. Chem. Soc., London, Trans., 103, 1653 (1913).

8217. Burton, H., Shoppee, C. W., Wilson, C. L., J. Chem. Soc., London, 720 (1933).

8222. Bergel, F., Jacob, A., Todd, A. R., Work, T. S., J. Chem. Soc., London, 1375 (1938).

8226. Krafft, F., Weilandt, H., Ber. Deut. Chem. Ges., 29, 1316 (1896).

8227. Jacquerod, A., Wassmer, E., Ber. Deut. Chem. Ges., 37, 2531 (1904).

8232. Doering, W. E., Zeiss, H. H., J. Amer. Chem. Soc., 72, 147 (1950).

8319. Finck, J. L., Wilhelm, R. M., J. Amer. Chem. Soc., 47, 1577 (1925).

8330. Bottomley, G. A., Spurling, T. H., Nature (London), 195, 900 (1962).

8343. Zmaczynski, Al., J. Chim. Phys. Physicochim. Biol., 27, 503 (1930).

8358. Carothers, W. H., Berchet, G. J., J. Amer. Chem. Soc., 55, 2813 (1933).

8363. Cook, J. W., J. Chem. Soc., London, 456 (1932).

8465. Doolittle, A. K., Ind. Eng. Chem., 30(2), 189 (1938).

8471. Ralston, A. W., Christensen, C. W., Ind. Eng. Chem., 29(2), 194 (1937).

8480. Pastureau, Bader, Bull. Soc. Chim. Fr., 39(4), 1428 (1926).

Table 20. Citations for literature documents--Continued

8485. Levy, J., Tabart, A., Bull. Soc. Chim. Fr., 49(4), 1776 (1931).

8507. Strating, J., Backer, H. J., Rec. Trav. Chim. Pays-Bas, 55, 903 (1936).

8531. Hayden, J. G., O'Connell, J. P., Ind. Eng. Chem., Process Des. Develop., 14, 209 (1975).

8539. Goodwin, S. R., Newsham, D. M. T., J. Chem. Eng. Data, 19(4), 363 (1974).

8577. Pennington, R. E., Kobe, K. A., J. Amer. Chem. Soc., 79, 300 (1957).

8600. Mitchell, D. T., Marvel, C. S., J. Amer. Chem. Soc., 55, 4276 (1933).

8672. Parks, G. S., Chaffee, C. S., J. Phys. Chem., 31, 439 (1927).

8693. Andrews, D. H., Lynn, G., Johnston, J., J. Amer. Chem. Soc., 48, 1274 (1926).

8720. Williams, J. W., Daniels, F., J. Amer. Chem. Soc., 47, 1490 (1925).

8731. Lesteva, T. M., Khrapkova, E. I., Gilmutdinova, V. A., Chernaya, V. I., Sire, E. M., J. Appl. Chem. USSR, 47(8), 1813 (1974).

8739. Yakubson, A. M., Mel'nichenko, M. Ya., Yakubson, E. Ya., Trofimov, V. I., J. Appl. Chem. USSR, 47, 2667 (1974).

8766. Dziewonski, K., Marusinska, M., Bull. Int. Acad. Pol. Sci. Lett., Cl. Sci. Math. Nat., Ser. A, 316 (1938).

8768. Lecat, M., C. R. Acad. Sci., 222, 733 (1946).

8831. Ferguson, A., Hakes, J. A., Proc. Phys. Soc., London, 41, 214 (1929).

8860. Atoyan, V. A., Mamedov, I. A., Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.- Tekh. Mat. Nauk, (1), 119 (1974).

8915. Gorodetskii, I. Ya., Olevskii, V. M., Khim. Tekhnol. Topl. Masel, 7(11), 50 (1962).

Table 20. Citations for literature documents--Continued

8971. Hanson, D. O., Van Winkle, M., J. Chem. Eng. Data, 12(3), 319 (1967).

9002. Grolier, J.-P. E., Benson, G. C., Picker, P., J. Chem. Eng. Data, 20(3), 243 (1975).

9027. Anderson, L. N., Kudchadker, A. P., Eubank, P. T., J. Chem. Eng. Data, 13(3), 321 (1968).

9079. Colonge, J., Mostafavi, K., Bull. Soc. Chim. Fr., Mem., 6, 342 (1939).

9083. Bardan, D., Bull. Soc. Chim. Fr., Series 4, 49, 1875 (1931).

9084. Colonge, J., Bull. Soc. Chim. Fr., Series 4, 41, 325 (1927).

9085. Dubois, J. E., Luft, R., Bull. Soc. Chim. Fr., 1153 (1954).

9138. Karr, A. E., Bowes, W. M., Scheibel, E. G., Anal. Chem., 23, 459 (1951).

9203. Sood, S. K., Haselden, G. G., AIChE J., 16(5), 891 (1970).

9277. Thomas, K. T., McAllister, R. A., AIChE J., 3(2), 161 (1957).

9441. Clemmensen, E., Ber. Deut. Chem. Ges., 46, 1837 (1913).

9442. Daniloff, S., Venus-Danilova, E., Ber. Deut. Chem. Ges., 59, 377 (1926).

9493. Schutt, H. C., Chem. Eng. Progr., 56(1), 53 (1960).

9526. Clusius, K., Ringer, W., Z. Phys. Chem., Abt. A, 187, 186 (1940).

9538. Bruehl, J. W., Justus Liebigs Ann. Chem., 203, 1 (1880).

9546. Beckmann, E., Faust, O., Z. Phys. Chem., Stoechiom. Verwandschaftslehre, 89, 235 (1915).

9598. Bouquet, F., Paquot, C., Bull. Soc. Chim. Fr., 440 (1949).

9712. Ceuterick, P., Bull. Soc. Chim. Belg., 45, 545 (1936).

Table 20. Citations for literature documents--Continued

9713. Baerts, F., Bull. Soc. Chim. Belg., 31, 421 (1922).

9717. Chiurdoglu, G., Bull. Soc. Chim. Belg., 43, 35 (1934).

9729. Capitani, C., Mugnaini, E., Chim. Ind. (Milan), 34, 193 (1952).

9743. Anderson, D. G., Smith, J. C., J. Inst. Petrol., London, 38, 415 (1952).

9754. Cook, N. C., Ph.D. Dissertation, Pennsylvania State College, University Park, Pennsylvania, 1943.

9767. Kozempel, M. F., Kelly, C. M., J. Chem. Eng. Data, 20(4), 367 (1975).

9819. Nothnagel, K.-H., Abrams, D. S., Prausnitz, J. M., Ind. Eng. Chem., Process Des. Develop., 12(1), 25 (1973).

9860. Hurd, C. D., Cohen, F. L., J. Amer. Chem. Soc., 53, 1068 (1931).

9862. Signaigo, F. K., Cramer, P. L., J. Amer. Chem. Soc., 55, 3326 (1933).

9874. Kohler, E. P., Tishler, M., Potter, H., Thompson, H. T., J. Amer. Chem. Soc., 61, 1057 (1939).

9920. Thorpe, T. E., Jones, L. M., J. Chem. Soc., London, Trans., 63, 273 (1893).

9921. Butz, L. W., Butz, E. W. J., Gaddis, A. M., J. Org. Chem., 5, 171 (1940).

9923. Vogel, A. I., J. Chem. Soc., London, 1323 (1938).

9948. Irving, R. J., Ribeiro da Silva, M. A. V., J. Chem. Soc., Dalton Trans., (9), 798 (1975).

9967. Nelson, O. A., Senseman, C. E., Ind. Eng. Chem., 15(6), 621 (1923).

10015. Murphy, K. P., J. Chem. Eng. Data, 9(2), 259 (1964).

10037. Jones, L. G., M.S. Thesis, Ohio State University, Columbus, Ohio, 1959.

Table 20. Citations for literature documents--Continued

10044. Van Ness, H. C., Kochar, N. K., J. Chem. Eng. Data, 12(1), 38 (1967).

10073. Oetting, F. L., J. Chem. Eng. Data, 10(2), 122 (1965).

10131. McAdam, E. H., Jr., M.S. Thesis, Ohio State University, Columbus, Ohio, 1958.

10163. Boje, L., Hvidt, A., J. Chem. Thermodyn., 3, 663 (1971).

10165. Benson, G. C., Murakami, S., Jones, D. E. G., J. Chem. Thermodyn., 3(5), 719 (1971).

10253. Ambrose, D., Sprake, C. H. S., Townsend, R., J. Chem. Thermodyn., 6, 693 (1974).

10318. Ambrose, D., Ellender, J. H., Lees, E. B., Sprake, C. H. S., Townsend, R., J. Chem. Thermodyn., 7, 453 (1975).

10358. Garrett, G. R., Van Winkle, M., J. Chem. Eng. Data, 14(3), 302 (1969).

10397. Bailey, A. V., Mitcham, D., Skau, E. L., J. Chem. Eng. Data, 15(4), 542 (1970).

10449. Teller, A. J., Walsh, T. J., J. Chem. Eng. Data, 4(3), 279 (1959).

10472. Terry, T. D., Kepner, R. E., Webb, A. D., J. Chem. Eng. Data, 5(4), 403 (1960).

10483. Wright, F. J., J. Chem. Eng. Data, 6(3), 454 (1961).

10531. Vojtko, J., Cihova, M., J. Chem. Eng. Data, 17(3), 337 (1972).

10537. Neely, W. C., Hall, T. D., J. Chem. Eng. Data, 17(3), 294 (1972).

10539. Haddad, P. O., Edmister, W. C., J. Chem. Eng. Data, 17(3), 275 (1972).

10550. Bardi, G., Gigli, R., Malaspina, L., Piacente, V., J. Chem. Eng. Data, 18(2), 126 (1973).

Table 20. Citations for literature documents--Continued

10560. Scheller, W. A., Narasimha Rao, S. V., J. Chem. Eng. Data, 18(2), 223 (1973).

10569. Meyer, E. F., Hotz, R. D., J. Chem. Eng. Data, 18(4), 359 (1973).

10579. Miller, K. J., Wu, J.-I., J. Chem. Eng. Data, 18(3), 262 (1973).

10586. Puri, P. S., Polak, J., Ruether, J. A., J. Chem. Eng. Data, 19(1), 87 (1974).

10697. Murogova, R. A., Tudorovskaya, G. L., Gridin, I. D., Yurchuk, A. P., Pleskach, N. I., Kozlova, V. D., Bazyleva, T. V., Safonova, N. A., Serafimov, L. A., J. Appl. Chem. (Leningrad), 45(4), 837 (1972).

10707. Parthasarathy, S., Proc. Indian Acad. Sci., Sect. A, 4, 59 (1936).

10722. Ham, W. R., Churchill, J. C., Ryder, H. M., J. Franklin Inst., 186, 15 (1918).

10759. Colonge, J., Pichat, L., C. R. Acad. Sci., 226, 673 (1948).

10763. Meehan, G. F., Murphy, N. F., Chem. Eng. Sci., 20, 757 (1965).

10830. Vinichenko, I. G., Susarev, M. P., J. Appl. Chem. USSR, 39(7), 1475 (1966).

10834. Zharov, V. T., Malegina, N. D., Morachevskii, A. G., J. Appl. Chem. USSR, 38(9), 2089 (1965).

10841. Marinichev, A. N., Susarev, M. P., J. Appl. Chem. USSR, 38(2), 371 (1965).

10843. Horiuti, J., Sci. Pap. Inst. Phys. Chem. Res. (Jpn), 17(341), 125 (1931).

10881. Zaalishvili, Sh. D., Belousova, Z. S., Russ. J. Phys. Chem., 38, 269 (1964).

10887. Gelperin, N. I., Zelenetskii, N. N., Russ. J. Phys. Chem., 34, 1059 (1960).

Table 20. Citations for literature documents--Continued

10889. Zaalishvili, S. D., Kolysko, L. E., Russ. J. Phys. Chem., 34, 1223 (1960).

10901. Nickerson, J. K., Kobe, K. A., McKetta, J. J., J. Phys. Chem., 65, 1037 (1961).

10968. Zharov, V., Vitman, T., Viit, Kh., Kudryavtseva, L., Eesti NSV Tead. Akad. Toim., Keem., Geol., 20(3), 206 (1971).

10972. DiZio, S. F., Ph.D. Dissertation, Rensselaer Polytechnic Institute, Troy, New York, 1964.

10983. Khorevskaya, A. S., Byk, S. Sh., J. Appl. Chem. USSR, 41(11), 2420 (1968).

10998. Zharov, V. T., Buevich, T. A., J. Appl. Chem. USSR, 41(9), 1911 (1968).

11006. Khorevskaya, A. S., Byk, S. Sh., J. Appl. Chem. USSR, 40(2), 451 (1967).

11008. Bakhtyukhova, G. N., Demidova, Yu. A., Kiryakov, V. N., Usyukin, I. P., Shleinikov, V. M., J. Appl. Chem. USSR, 40(3), 592 (1967).

11017. Tonomura, T., Uehara, K., Bull. Chem. Soc. Jap., 6, 255 (1931).

11019. Campbell, A. N., Chatterjee, R. M., Can. J. Chem., 46, 575 (1968).

11020. Campbell, A. N., Chatterjee, R. M., Can. J. Chem., 47, 3893 (1969).

11049. Fried, V., Pick, J., Collect. Czech. Chem. Commun., 26, 954 (1961).

11052. Wenzel, W., Pirak, H., Collect. Czech. Chem. Commun., 6, 54 (1934).

11072. Byk, S. Sh., Shcherbak, L. I., Zh. Fiz. Khim., 30, 56 (1956).

11081. Kraus, J., Linek, J., Collect. Czech. Chem. Commun., 36(7), 2547 (1971).

Table 20. Citations for literature documents--Continued

11097. Magiera, B., Brostow, W., J. Phys. Chem., 75(26), 4041 (1971).

11130. Renker, W., Geiseler, G., Quitzsch, K., Z. Phys. Chem. (Leipzig), 255, 549 (1974).

11162. Rivenq, F., Bull. Soc. Chim. Fr., (10), 3782 (1972).

11178. Altsybeeva, A. I., Morachevskii, A. G., Russ. J. Phys. Chem., 38, 849 (1964).

11233. Seetharamaswamy, V., Subrahmanyam, V., Dakshinamurty, P., J. Appl. Chem., 19(12), 359 (1969).

11241. Donald, M. B., Ridgway, K., J. Appl. Chem., 8, 408 (1958).

11243. Kurmanadha Rao, K. V., Krishnamurty, V. V. G., Venkata Rao, C., J. Appl. Chem., 7, 535 (1957).

11322. Ratzsch, M. T., Strauch, G., Z. Phys. Chem. (Leipzig), 249, 243 (1972).

11329. Qu tzsch, K., Hofmann, H.-P., Pfestorf, R., Geiseler, G., Z. Phys. Chem. (Leipzig), 235, 99 (1967).

11364. Rabinovich, I. B., Nikolaev, P. N., Russ. J. Phys. Chem., 34(10), 1087 (1960).

11373. Bjerrum, N., Jozefowicz, E., Z. Phys. Chem., Abt. A, 159, 194 (1932).

11410. Abbott, M. M., Floess, J. K., Walsh, G. E., Jr., Van Ness, H. C., AIChE J., 21(1), 72 (1975).

11414. Tsonopoulos, C., AIChE J., 21(4), 827 (1975).

11494. Gaile, A. A., Leitman, Ya. I., Russ. J. Phys. Chem., 41(11), 1550 (1967).

11502. Khodzhaev, S. A., Belinskii, B. A., Nozdrev, V. F., Russ. J. Phys. Chem., 42(6), 779 (1968).

11733. Gross, P., Rintelen, J. C., Saylor, J. H., J. Phys. Chem., 43, 197 (1939).

Table 20. Citations for literature documents--Continued

11735.	Grosse, A. V., Wackher, R. C., Linn, C. B., J. Phys. Chem., 44, 275 (1940).
11752.	Efron, A., Blom, R. H., J. Phys. Chem., 51, 480 (1947).
11773.	Fuge, E. T. J., Bowden, S. T., Jones, W. J., J. Phys. Chem., 56, 1013 (1952).
11857.	Mueller, C. R., Kearns, E. R., J. Phys. Chem., 62, 1441 (1958).
11865.	Howard, K. S., Pike, F. P., J. Phys. Chem., 63, 311 (1959).
11882.	Rastogi, R. P., Nigam, R. K., J. Phys. Chem., 64, 722 (1960).
11897.	Nickerson, J. K., Kobe, K. A., McKetta, J. J., J. Phys. Chem., 65, 1037 (1961).
12038.	Meyer, E. F., Wagner, R. E., J. Phys. Chem., 70(10), 3162 (1966).
12089.	Deshpande, D. D., Bhatgadde, L. G., J. Phys. Chem., 72(1), 261 (1968).
12385.	Weizmann, A., Trans. Faraday Soc., 36, 329 (1940).
12387.	Weizmann, A., Trans. Faraday Soc., 35, 978 (1940).
12453.	Soundararajan, S., Vold, M. J., Trans. Faraday Soc., 54, 1155 (1958).
12455.	Hind, R. K., McLaughlin, E., Ubbelohde, A. R., Trans. Faraday Soc., 55, 21 (1959).
12590.	Flory, P. J., Hocker, H., Trans. Faraday Soc., 67, 2258 (1971).
12628.	Morgan, J. L. R., Kramer, B. J., J. Amer. Chem. Soc., 35, 1834 (1913).
12654.	Hildebrand, J. H., Duschak, A. D., Foster, A. H., Beebe, C. W., J. Amer. Chem. Soc., 39, 2293 (1917).
12707.	Morgan, J. L. R., Lammert, O. M., J. Amer. Chem. Soc., 46, 881 (1924).

Table 20. Citations for literature documents--Continued

12725. Garland, C. E., Reid, E. E., J. Amer. Chem. Soc., 47, 2333 (1925).

12727. Quayle, O. R., Reid, E. E., J. Amer. Chem. Soc., 47, 2357 (1925).

12836. Lee, H. H., Warner, J. C., J. Amer. Chem. Soc., 55, 209 (1933).

12938. Davis, G. L., Burrows, G. H., J. Amer. Chem. Soc., 58, 311 (1936).

12996. Thomas, R. J., Campbell, K. N., Hennion, G. F., J. Amer. Chem. Soc., 60, 718 (1938).

13065. Ginnings, P. M., Plonk, D., Carter, E., J. Amer. Chem. Soc., 62, 1923 (1940).

13074. Stuckey, J. M., Saylor, J. H., J. Amer. Chem. Soc., 62, 2922 (1940).

13129. Oesper, P. F., Smyth, C. P., Kharasch, M. S.., J. Amer. Chem. Soc., 64, 937 (1942).

13138. Owen, K., Quayle, O. R., Clegg, W. J., J. Amer. Chem. Soc., 64, 1294 (1942).

13151. Brant, J. H., J. Amer. Chem. Soc., 64, 2224 (1942).

13155. Saylor, J. H., Baxt, V. J., Gross, P. M., J. Amer. Chem. Soc., 64, 2742 (1942).

13169. Davis, R., Bridge, H. S., Svirbely, W. J., J. Amer. Chem. Soc., 65, 857 (1943).

13198. Curran, B. C., J. Amer. Chem. Soc., 67, 1835 (1945).

13199. Kumler, W. D., J. Amer. Chem. Soc., 67, 1901 (1945).

13236. Stross, F. H., Monger, J. M., De V. Finch, H., J. Amer. Chem. Soc., 69, 1627 (1947).

13274. Redemann, C. E., Chaikin, S. W., Fearing, R. B., J. Amer. Chem. Soc., 70, 2582 (1948).

Table 20. Citations for literature documents--Continued

13276. Goldsmith, M., Wheland, G. W., J. Amer. Chem. Soc., 70, 2632 (1948). The Phenyl-Carbon-Phenyl Angle in 1,1-Diphenylcyclopropane.

13284. Diepen, G. A. M., Scheffer, F. E. C., J. Amer. Chem. Soc., 70, 4081 (1948).

13292. Van Volkenburgh, R., Greenlee, K. W., Derfer, J. M., Boord, C. E., J. Amer. Chem. Soc., 71, 172 (1949).

13305. Birch, S. F., Dean, R. A., Fidler, F. A., Lowry, R. A., J. Amer. Chem. Soc., 71, 1362 (1949).

13330. Whitmore, F. C., Goldsmith, D. P. J., Cook, N. C., Yarze, J. C., Ecke, G. G., J. Amer. Chem. Soc., 72, 53 (1950).

13362. Svirbely, W. J., Lander, J. J., J. Amer. Chem. Soc., 72, 3756 (1950).

13407. Lagemann, R. T., Gwin, R., Lester, C. T., Proffit, J. R., Suratt, E. C., J. Amer. Chem. Soc., 73, 3213 (1951).

13420. Condon, F. E., J. Amer. Chem. Soc., 73, 4675 (1951).

13423. Randall, M., McKenna, F. E., J. Amer. Chem. Soc., 73, 4859 (1951).

13438. Lagemann, R. T., Landrum, B. F., Lester, C. T., Milner, O., McElroy, E. G., J. Amer. Chem. Soc., 74, 1602 (1952).

13517. Nagakura, S., Kuboyama, A., J. Amer. Chem. Soc., 76, 1003 (1954).

13565. Pines, H., Marechal, J., J. Amer. Chem. Soc., 77, 2819 (1955).

13566. Pilpel, N., J. Amer. Chem. Soc., 77, 2949 (1955).

13569. Rogers, M. T., J. Amer. Chem. Soc., 77, 3681 (1955).

13585. Huitric, A. C., Kumler, W. D., J. Amer. Chem. Soc., 78, 614 (1956).

13613. Kurita, Y., Kubo, M., J. Amer. Chem. Soc., 79, 5460 (1957).

Table 20. Citations for literature documents--Continued

13661. Allinger, N. L., Allinger, J., Freiberg, L. A., Czaja, R. F., LeBel, N. A., J. Amer. Chem. Soc., 82, 5876 (1960).

13674. Kumler, W. D., Lewis, A., Meinwald, J., J. Amer. Chem. Soc., 83, 4591 (1961).

13681. Allinger, N. L., DaRooge, M. A., J. Amer. Chem. Soc., 84, 4561 (1962).

13799. Mayberry, M. G., Aston, J. G., J. Amer. Chem. Soc., 56, 2682 (1934).

13811. Atkinson, R. W., Yoshida, H., J. Chem. Soc., London, 41, 49 (1882).

13823. Colman, H. G., Perkin, W. H., J. Chem. Soc., London, 53, 185 (1888).

13826. Carnelley, T., Thomson, A., J. Chem. Soc., London, 53, 782 (1888).

13834. Young, S., J. Chem. Soc., London, 59, 626 (1891).

13835. Perkin, W. H., J. Chem. Soc., London, 59, 786 (1891).

13837. Perkin, W. H., Sinclair, W., J. Chem. Soc., London, 61, 36 (1892).

13839. Perkin, W. H., J. Chem. Soc., London, 61, 800 (1892).

13842. Ramsay, W., Shields, J., J. Chem. Soc., London, 63, 1089 (1893).

13846. Perkin, W. H., J. Chem. Soc., London, 65, 815 (1894).

13847. Perkin, W. H., J. Chem. Soc., London, 69, 1 (1896).

13952. Gardner, T. E., Perkin, W. H., Jr., J. Chem. Soc., London, 91, 848 (1907).

13974. Vanstone, E., J. Chem. Soc., London, 95, 590 (1909).

13996. Deakin, S., Wilsmore, N. T. M., J. Chem. Soc., London, 97, 1968 (1910).

Table 20. Citations for literature documents--Continued

13997. Chick, F., Wilsmore, N. T. M., J. Chem. Soc., London, 97, 1978 (1910).

14003. Pickard, R. H., Kenyon, J., J. Chem. Soc., London, 99, 45 (1911).

14025. Clarke, H. T., J. Chem. Soc., London, 101, 1788 (1912).

14043. Vanstone, E., J. Chem. Soc., London, 103, 1826 (1913).

14049. Worley, R. P., J. Chem. Soc., London, 105, 273 (1914).

14087. Bramley, A., J. Chem. Soc., London, 109, 10 (1916).

14089. Bramley, A., J. Chem. Soc., London, 109, 469 (1916).

14102. Price, T. W., J. Chem. Soc., London, 115, 1116 (1919).

14146. Archibald, E. H., Ure, W., J. Chem. Soc., London, 125, 726 (1924).

14158. Lowry, T. M., Cutter, J. O., J. Chem. Soc., London, 127, 604 (1925).

14192. Garner, F. B., Sugden, S., J. Chem. Soc., London, 2877 (1927).

14195. Sugden, S., J. Chem. Soc., London, 410 (1928).

14198. Lowry, T. M., MacConkey, C. A. H., Burgess, H., J. Chem. Soc., London, 1333 (1928).

14204. Vogel, I., J. Chem. Soc., London, 2010 (1928).

14219. Vogel, A. I., Oommen, M. P., J. Chem. Soc., London, 768 (1930).

14310. Burawoy, A., Markowitsch-Burawoy, I., J. Chem. Soc., London, 36 (1936).

14316. Bergmann, E., J. Chem. Soc., London, 402 (1936).

14356. Hammick, D. L., Hampson, G. C., Jenkins, G. I., J. Chem. Soc., London, 1263 (1938).

14380. Cowan, D. M., Jeffery, G. H., Vogel, A. I., J. Chem. Soc., London, 1862 (1939).

Table 20. Citations for literature documents--Continued

14382. Gillespie, D. T. C., Macbeth, A. K., Mills, J. A., J. Chem. Soc., London, 280 (1940).

14415. Catch, J. R., Elliott, D. F., Hey, D. H., Jones, E. R. H., J. Chem. Soc., London, 272 (1948).

14417. Vogel, A. I., J. Chem. Soc., London, 610 (1948).

14422. Jeffery, G. H., Vogel, A. I., J. Chem. Soc., London, 1804 (1948).

14453. Bentley, J. B., Everard, K. B., Marsden, R. J. B., Sutton, L. E., J. Chem. Soc., London, 2957 (1949).

14461. Angyal, C. L., Le Fevre, R. J. W., J. Chem. Soc., London, 562 (1950).

14464. Le Fevre, C. G., Le Fevre, R. J. W., J. Chem. Soc., London, 1829 (1950).

14512. Le Fevre, R. J. W., Youhotsky, I., J. Chem. Soc., London, 1318 (1953).

14576. Boud, A. H., Smith, J. W., J. Chem. Soc., London, 4507 (1956).

14597. Smith, J. W., J. Chem. Soc., London, 4050 (1957).

14618. Le Fevre, C. G., Le Fevre, R. J. W., Purnachandra Rao, B., J. Chem. Soc., London, 2340 (1959).

14649. Aroney, M., Izsak, D., Le Fevre, R., J. W., J. Chem. Soc., London, 4148 (1961).

14650. Cureton, P. H., Le Fevre, C. G., Le Fevre, R. J. W., J. Chem. Soc., London, 4447 (1961).

14654. Bramley, R., Le Fevre, R. J. W., J. Chem. Soc., London, 56 (1962).

14656. Eckert, J. M., Le Fevre, R. J. W., J. Chem. Soc., London, 1081 (1962).

14673. Le Fevre, R. J. W., Sundaram, A., J. Chem. Soc., London, 4756 (1962).

Table 20. Citations for literature documents--Continued

14677. Le Fevre, R. J. W., Sundaram, A., Sundaram, K. M. S., J. Chem. Soc., London, 974 (1963).

14697. Aroney, M. J., Corfield, M. G., Le Fevre, R. J. W., J. Chem. Soc., London, 648 (1964).

14712. Cumper, C. W. N., Leton, G. B., Vogel, A. I., J. Chem. Soc., London, 2067 (1965).

14713. Arrowsmith, G. B., Jeffery, G. H., Vogel, A. I., J. Chem. Soc., London, 2072 (1965).

14727. Chen, C.-Y., Le Fevre, R. J. W., J. Chem. Soc., London, 5528 (1965).

14792. Ascah, R. G., Burton, M., Ricci, J. E., Davis, T. W., J. Chem. Phys., 14, 487 (1946).

14815. Lagemann, R. T., McMillan, D. R., Jr., Woolf, W. E., J. Chem. Phys., 17, 369 (1949).

14905. Rathmann, G. B., Curtis, A. J., McGeer, P. L., Smyth, C. P., J. Chem. Phys., 25, 413 (1956).

15034. Plaush, A. C., Pace, E. L., J. Chem. Phys., 47, 44 (1967).

15080. Akella, J., Kennedy, G. C., J. Chem. Phys., 52(2), 970 (1970).

15290. Dakshinamurty, P., Krishnamurty, V. V. G., Rao, C. S., Venkata Rao, C., Indian J. Technol., 1, 196 (1963).

15340. Callendar, H. L., Griffiths, E. H., Chem. News., 63, 1 (1891).

15341. Waidner, C. W., Burgess, G. K., Chem. News., 103, 25 (1911).

15362. Niini, A., Ann. Acad. Sci. Fenn., Ser. A, 55(8), 1 (1940).

15411. Naidu, P. R., Aust. J. Chem., 23, 967 (1970).

15446. Meehan, G. F., Murphy, N. F., Chem. Eng. Sci., 20, 757 (1965).

15518. Sokolov, V. V., Zhilina, L. P., Mishchenko, K. P., J. Appl. Chem. USSR, 36(4), 721 (1963).

Table 20. Citations for literature documents--Continued

15521. Kudryavtseva, L. S., Susarev, M. P., J. Appl. Chem. USSR, 36(6), 1180 (1963).

15556. Pestrikov, S. V., Nasrtdinova, N. Z., J. Appl. Chem. USSR, 38(7), 1587 (1965).

15628. Frolov, A. F., Loginova, M. A., Kirsanova, G. N., J. Appl. Chem. USSR, 42(9), 1963 (1969).

15650. Konobeev, B. I., Lyapin, V. V., J. Appl. Chem. USSR, 43(4), 806 (1970).

15685. Yakubson, A. M., Blyakhman, L. I., Mel'nichenko, M. Y., Efimova, Z. V., Trofimov, V. I., J. Appl. Chem. USSR, 44(5), 1220 (1971).

15698. Krupatkin, I. L., Glagoleva, M. F., J. Appl. Chem. USSR, 44(10), 2433 (1971).

15701. Komarov, V. M., Pelevina, R. S., Soboleva, E. V., J. Appl. Chem. USSR, 44(11), 2681 (1971).

15702. Granzhan, V. A., Kirillova, O. G., J. Appl. Chem. USSR, 45(1), 238 (1972).

15755. Terent'eva, A. A., Krumgal'z, B. S., Gerzhberg, Y. I., J. Appl. Chem. USSR, 46(5), 1213 (1973).

15758. Komarov, V. M., Boldyrev, A. V., Pelevina, R. S., J. Appl. Chem. USSR, 46(6), 1465 (1973).

15776. Loginova, M. A., Frolov, A. F., Bol'shakova, L. N., Simanov, N. A., Ob''edkova, L. V., J. Appl. Chem. USSR, 47(1), 98 (1974).

15791. Mironenko, V. F., Garber, Y. N., Bormatov, B. K., J. Appl. Chem. USSR, 47(4), 836 (1974).

15869. Ishikawa, T., Hirata, M., Iizuka, Y., Kagaku Kogaku, 36(5), 566 (1972).

16255. Glowka, S., Zawisza, A. C., Bull. Acad. Pol. Sci., Ser. Sci. Chim., 17, 365 (1969).

16274. Subnis, S. W., Bhagwat, W. V., Kanugo, R. B., J. Indian Chem. Soc., 25, 575 (1948).

Table 20. Citations for literature documents--Continued

16313. Garland, F. M., Hoerr, C. W., Pool, W. O., Ralston, A. W., J. Org. Chem., 8, 344 (1943).

16355. Nakanishi, K., Touhara, H., Sato, K., Nagao, M., Bull. Chem. Soc. Jap., 41(10), 2536 (1968).

16370. Nakanishi, K., Toyama, O., Bull. Chem. Soc. Jap., 45(10), 3210 (1972).

16497. Boublik, T., Aim, K., Collect. Czech. Chem. Commun., 37(11), 3513 (1972).

16545. Gorodetskii, I. Ya., Olevskii, V. M., Khim. Tekhnol. Topl. Masel, (11), 50 (1962).

16574. Serafimov, L. A., Timofeev, V. S., Balashov, M. I., Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol., 5, 722 (1962).

16587. Zhilina, L. P., Mishchenko, K. P., Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol., 10(9), 1001 (1967).

16683. Shakhparonov, M. I., Martynova, M. E., Zh. Fiz. Khim., 27, 197 (1953).

16695. Skvortsova, O. V., Chashchin, A. M., Perinykh, M. S., Gidroliz. Lesokhim. Prom., 25(1), 16 (1972).

16843. Braude, G. E., Dedova, I. V., Shakhova, S. F., Khim. Prom. (Moscow), (3), 186 (1965).

16911. Edwards, J., Encina, M. V., Z. Naturforsch. A, 25, 45 (1970).

17032. Low, D. I. R., Moelwyn-Hughes, E. A., Proc. Royal Soc., Ser. A, 267, 384 (1962).

17059. Friend, J. N., Hargreaves, W. D., Phil. Mag., Series 7, 34, 643 (1943).

17061. Friend, J. N., Hargreaves, W. D., Phil. Mag., Series 7, 35, 136 (1944).

17194. Krumgalz, B. S., Gerzhberg, Y. I., Volnukhina, T. M., Kornilova, Y. I., J. Gen. Chem. USSR, 41(1), 35 (1971).

Table 20. Citations for literature documents--Continued

17332. Rousset, M. L., Bull. Soc. Chim. Fr., Mem., 15, 58 (1896).

17342. Burriel, F., An. Real Soc. Espan. Fis. Quim., 29, 89 (1931).

17377. Fischer, L. O., Bull. Soc. Chim. Belg., 49, 129 (1940).

17509. Schwers, F., J. Chim. Phys. Physicochim. Biol., 9, 15 (1911).

17533. Ueberreiter, K., Orthmann, H.-J., Z. Naturforsch. A, 5, 101 (1950).

17538. Edwards, J. L., Schaefer, K., Z. Naturforsch. A, 19, 136 (1964).

17776. Evans, R. F., Smith, J. C., Strauss, F. B., J. Inst. Petrol., London, 40, 7 (1954).

17908. Becker, F., Fries, E. W., Kiefer, M., Pflug, H. D., Z. Naturforsch. A, 25, 677 (1970).

17993. Harand, J., Monatsh. Chem., 65, 153 (1935).

18048. Harris, H. G., Jr., Ph.D. Dissertation, University of California, Berkeley, California, 1968.

18104. Mentzer, Ch., Buu-Hoi, Cagniant, P., Bull. Soc. Chim. Fr., 10, 141 (1943).

18117. Brusset, H., Duboc, C., Coppel, A. M., Bull. Soc. Chim. Fr., 1203 (1966).

18125. Serpinskii, V. V., Voitkevich, S. A., Lyuboshits, N. Yu., Zh. Fiz. Khim., 31, 1278 (1957).

18151. Khera, R., M.S. Thesis, Ohio State University, Columbus, Ohio, 1968.

18275. Pluddemann, H., Schafer, Kl., Z. Elektrochem., 63, 1024 (1959).

18314. Grunert, H., Z. Anorg. Allg. Chem., 164, 256 (1927).

18383. Chun, S. W., M.S. Thesis, The Ohio State University, Columbus, Ohio, 1959.

Table 20. Citations for literature documents--Continued

18392. Lecat, M., Bull. Cl. Sci. Acad. Roy. Belg., 29, 273 (1943).

18394. Lecat, M., Bull. Cl. Sci. Acad. Roy. Belg., 33, 160 (1947).

18395. Lecat, M., Ann. Soc. Sci. Bruxelles, Ser. B, 45(1), 284 (1925).

18400. Simon, I., Bull. Soc. Chim. Belg., 38, 47 (1929).

18421. Hennings, P., Von Weber, U., J. Prakt. Chem., 18, 91 (1962).

18439. Geiseler, G., Ratzsch, M., Ber. Bunsenges. Phys. Chem., 69(6), 485 (1965).

18442. Geiseler, G., Koehler, H., Ber. Bunsenges. Phys. Chem., 72, 697 (1968).

18512. Siegelman, I., Sorum, C. H., Can. J. Chem., 38, 2015 (1960).

18580. Timmermans, M. J., Hennaut-Roland, J. Chim. Phys. Physicochim. Biol., 56, 984 (1959).

18584. Loiseleur, H., Merlin, J.-C., Paris, R. A., J. Chim. Phys. Physicochim. Biol., 61, 1231 (1964).

18601. Monfort, J. P., Vidal, J., Renon, H., J. Chim. Phys. Physicochim. Biol., 67, 748 (1970).

18654. Wolf, G., Helv. Chim. Acta., 55, 1446 (1972).

18659. Kolbel, H., Klamann, D., Arends, E., Looman, W., Brennst.-Chem., 40, 281 (1959).

18715. Lecat, M., Rec. Trav. Chim. Pays-Bas, 45, 620 (1926).

18716. Lecat, M., Rec. Trav. Chim. Pays-Bas, 46, 240 (1927).

18717. Lecat, M., Rec. Trav. Chim. Pays-Bas, 47, 13 (1928).

18774. Jakubicek, J., Collect. Czech. Chem. Commun., 28, 3180 (1963).

18881. Guillory, J. K., J. Amer. Pharm. Ass., Sci. Ed., 56(1), 72 (1967).

18956. Sellers, P., Sunner, S., Acta Chem. Scand., 16, 46 (1962).

Table 20. Citations for literature documents--Continued

18984. Sellers, P., Acta Chem. Scand., 25, 2099 (1971).

18985. Sellers, P., Acta Chem. Scand., 25, 2189 (1971).

19014. Krafft, F., Chem. Ber., 15, 1711 (1882).

19092. Lecat, M., Ann. Soc. Sci. Bruxelles, Ser. B, 47(1), 149 (1927).

19247. Centnerszwer, M., Teletow, Iv., Z. Elektrochem., 9, 799 (1903).

19348. Mauser, H., Z. Elektrochem., 65, 534 (1961).

19380. Atoyan, V. A., Mamedov, I. A., Izv. Vyssh. Ucheb. Zaved., Neft Gaz, 18(5), 74 (1975).

19402. Tugarev, I. A., Avdus, Z. I., Nozdrev, V. F., Zh. Fiz. Khim., 49, 1256 (1975).

19429. Engelmann, K., Bittrich, H. J., J. Prakt. Chem., Ser. 4, 19, 106 (1963).

19439. Quitzsch, K., Hofmann, H. P., Pfestorf, R., Geiseler, G., J. Prakt. Chem. 34(1-4), 145 (1966).

19447. Jakubicek, J., Collect. Czech. Chem. Commun., 28, 3180 (1963).

19466. Bruner, L., Chem. Ber., 27, 2102 (1894).

19470. Jaquerod, A., Wassmer, E., Chem. Ber., 37, 2531 (1904).

19474. Henderson, G. G., Henderson, J. A. R., Heilbron, I. M., Chem. Ber., 47, 876 (1914).

19625. Yergovich, T. W., Swift, G. W., Kurata, F., J. Chem. Eng. Data, 16, 222 (1971).

19637. Vojtko, J., Cihova, M., J. Chem. Eng. Data, 17, 337 (1972).

19667. Marshall, W. L., Jones, E. V., J. Inorg. Nucl. Chem., 36, 2319 (1974).

19668. Mitsukuri, S., Bull. Chem. Soc. Jap., 1, 30 (1926).

19673. Jackson, W., Hung, T. S., Hopkins, H. P., Jr., J. Chem. Thermodyn., 3(3), 347 (1971).

Table 20. Citations for literature documents--Continued

19676. Boje, L., Hvidt, A., J. Chem. Thermodyn., 3, 663 (1971).

19725. Parks, G. S., Kelley, K. K., J. Amer. Chem. Soc., 47, 2089 (1925).

19821. Young, S., Z. Phys. Chem. (Leipzig), 9, 221 (1892).

19842. Luginin, W., Z. Phys. Chem. (Leipzig), 19, 500 (1896).

19928. Drucker, K., Kassel, R., Z. Phys. Chem. (Leipzig), 76, 367 (1911).

19930. Faust, O., Z. Phys. Chem. (Leipzig), 79, 97 (1912).

19951. Schulze, A., Z. Phys. Chem. (Leipzig), 93, 368 (1919).

19962. Volmer, M., Kirchoff, P., Z. Phys. Chem. (Leipzig), 115, 233 (1925).

19999. Walden, P., Birr, E. J., Z. Phys. Chem., Abt. A, 153, 1 (1931).

20007. Neumann, K., Volker, E., Z. Phys. Chem., Abt. A, 161, 33 (1932).

20019. Schulz, G. V., Z. Phys. Chem., Abt. A, 184, 1 (1939).

20106. Wolf, K. L., Weghofer, H., Z. Phys. Chem., Abt. B, 39, 194 (1938).

20137. Rock, H., Schroder, W., Z. Phys. Chem. (Frankfurt am Main), 11, 41 (1957).

20179. Geiseler, G., Mehnert, E., Z. Phys. Chem. (Frankfurt am Main), 64, 26 (1969).

20312. Timmermans, J., Bull. Soc. Chim. Belg., 27, 334 (1914).

20317. Simon, I., Bull. Soc. Chim. Belg., 38, 47 (1929).

20318. Marti, F. B., Bull. Soc. Chim. Belg., 39, 590 (1930).

20402. Breusch, F. L., Kirkali, A., Fette, Seifen, Anstrichm., 70(11), 864 (1968).

Table 20. Citations for literature documents--Continued

20426. Rhim, J. N., Park, S. S., Lee, H. O., Hwahak Konghak, 12, 179 (1974).

20469. Leverett, G. F., Ph.D.Dissertation, Ohio State University, Columbus, Ohio, 1959.

20475. Cherry, R. H., Jr., Ph.D. Dissertation, The Ohio State University, Columbus, Ohio, 1966.

20484. Udovenko, V. V., Airapetova, R. P., J. Gen. Chem. USSR, 19, 585 (1949).

20486. Toropov, A. P., J. Gen. Chem. USSR, 26, 1453 (1956).

20519. Moroto, S., Watanabe, A., Kagaku Kogaku, 35(3), 370 (1971).

20529. Ishikawa, T., Iizuka, Y., Hirata, M., Kagaku Kogaku, 36(5), 563 (1972).

20587. Mian, A. A., Wingard, R. E., Pak. J. Sci. Res., 12, 53 (1960).

20615. Soczewinski, E., Wolski, T., Przem. Chem., 44(4), 189 (1965).

20670. Nitta, I., Seki, S., Chihara, H., Suzuki, K., Sci. Pap. Osaka Univ., 29, 1 (1951).

20674. Tsuruoka, S., Kojima, H., Senai Gakkaishi, 24(1), 27 (1968).

20707. Raridon, R. J., Kraus, K. A., U.S. Off. Saline Water, Res. Dev. Prog. Rep., (302), 52 (1968).

20711. Bodor, E., Bor, G., Maleczkine, M., Mesko, G., Mohai, B., Siposs, G., Veszpremi Vegyip. Egyet. Koezlem., 1, 63 (1957).

20774. Kanonnikoff, J., J. Prakt. Chem., Ser. 2, 31, 321 (1885).

20779. Lachowicz, B., J. Prakt. Chem., Ser. 2, 28, 154 (1883).

20809. Auwers, K., Eisenlohr, F., J. Prakt. Chem., Ser. 2, 82, 65 (1910).

20811. Auwers, K., Eisenlohr, F., 84, 37 (1911).

20813. Benrath, A., J. Prakt. Chem., Ser. 2, 87, 416 (1913).

Table 20. Citations for literature documents--Continued

20875. Asinger, F., Berger, W., Fanghanel, E., Muller, K. R., J. Prakt. Chem., Ser. 4, 22, 153 (1963).

20888. Quitzsch, K., Hofmann, H.-P., Pfestorf, R., Geiseler, G., J. Prakt. Chem., Ser. 4, 34, 145 (1966).

20914. Schmidt, G. C., Justus Liebigs Ann. Chem., 266, 266 (1891).

20930. Bruhl, J. W., Ber. Deut. Chem. Ges., 32, 1222 (1899).

21047. Albanesi, G., Pasquon, I., Genoni, P., Chim. Ind. (Milan), 39, 814 (1957).

21072. St. Pfau, A., Helv. Chim. Acta, 15, 1267 (1932).

21109. Ramsay, W., Young, S., Phil. Trans. Roy. Soc. London, Ser. A, 175, 37 (1884).

21198. Deich, A. Ya., Latv. PSR Zinat. Akad. Vestis, Kim. Ser., (1), 9 (1967).

21281. Lecat, M., Ann. Soc. Sci. Bruxelles, Ser. 1: M. A. P., 60, 163 (1946).

21283. Lecat, M., Ann. Soc. Sci. Bruxelles, Ser. 1: M. A. P., 60, 228 (1946).

21286. Lecat, M., Ann. Soc. Sci. Bruxelles, Ser. 1: M. A. P., 61, 148 (1947).

21365. Khodeeva, S. M., Dymova, R. P., Tr. Gos. Nauchno-Issled. Proektn. Inst. Azotn. Promsti, Prod. Org. Sint., (12), 39 (1971).

21388. Brazier, D. W., Freeman, G. R., Can. J. Chem., 47, 893 (1969).

21400. Vandoni, R., Mem. Poudres, 28, 236 (1938).

21419. Vilcu, R., Simion, A., Rev. Roum. Chim., 19, 977 (1974).

21527. Ratzsch, M. T., Strauch, G., Z. Phys. Chem. (Leipzig), 249(3-4), 243 (1972).

21544. Jamison, M. M., Lesslie, M. S., Turner, E. E., J. Inst. Petrol., London, 35, 590 (1949).

Table 20. Citations for literature documents--Continued

21545. Buck, F. R., Elsner, B. B., Henshall, T., Moore, T. S., Murray, A. R., Morrell, S. H., Muller, G., Plant, M. M. T., Smith, J. C., Wallsgrove, E. R., J. Inst. Petrol., London, 35, 631 (1949).

21584. Chang, Y. C., Wang, H. T., Huang, T., K'o Hsueh T'ung Pao, 5, 437 (1965).

21601. Mears, T. W., Fookson, A., Pomerantz, P., Rich, E. H., Dussinger, C. S., Howard, F. L., J. Res. Nat. Bur. Stand., 44, 299 (1950).

21602. Howard, F. L., Mears, T. W., Fookson, A., Pomerantz, P., Brooks, D. B., J. Res. Nat. Bur. Stand., 38, 365 (1947).

21752. Parks, G. S., Mosher, H. P., J. Chem. Phys., 37, 919 (1962).

21823. Heric, E. L., Brewer, J. G., J. Chem. Eng. Data, 16(3), 313 (1971).

21878. Maczynska, Z., Kreglewski, A., Bull. Acad. Pol. Sci., Ser. Sci. Chim., 12(8), 551 (1964).

21928. Zharov, V. T., Malegina, I. D., Morachevskii, A. G., Zh. Prikl. Khim. (Leningrad), 38(9), 2132 (1965).

21948. de Wilde, J. H., Z. Anorg. Allg. Chem., 233, 411 (1937).

21953. Zuskind, B., Kasarnovskii, I., Z. Anorg. Allg. Chem., 214, 385 (1933).

21997. Lecat, M., Rec. Trav. Chim. Pays-Bas, 47, 13 (1928).

22382. Pluddemann, H., Schafer, Kl., Z. Elektrochem., 63, 1024 (1959).

22388. Hennion, G. F., Banigan, T. F., Jr., J. Amer. Chem. Soc., 68(1), 1202 (1946).

22408. Bruhl, J. W., Justus Liebigs Ann. Chem., 235, 1 (1886).

22452. Auwers, K., Moosbrugger, W., Justus Liebigs Ann. Chem., 387, 167 (1912).

22466. Kiss, I., Szabo, E., Magy. Tud. Akad. Kozp. Fiz. Kut. Intez. Kozlem., 7, 218 (1960).

Table 20. Citations for literature documents--Continued

22530. Maher, P. J., Doctor of Science Dissertation, Washington University, St. Louis, Missouri, 1979.

22565. Goodman, I. A., Wise, P. H., Technical Note 2260, National Advisory Committee for Aeronautics, Washington, 1951.

22644. Smith, E. D., Thornsberry, W. L., J. Chem. Eng. Data, 15, 296 (1970).

22654. Hartley, W. N., Dobbie, J. J., J. Chem. Soc., 73, 598 (1898).

22665. Guttmann, L. F., J. Amer. Chem. Soc., 29, 345 (1907).

22670. Homeyer, A. H., Whitmore, F. C., Wallingford, V. H., J. Amer. Chem. Soc., 55, 4209 (1933).

22680. Mann, C. A., Montonna, R. E., Larian, M. G., Ind. Eng. Chem., 28, 598 (1936).

22755. Anderson, E. P., Crawford, J. V., Sherrill, M. L., J. Amer. Chem. Soc., 68, 1294 (1946).

22760. White, A. H., Bishop, W. S., J. Amer. Chem. Soc., 62, 8 (1940).

22762. Benson, S. W., Kistiakowsky, G. B., J. Amer. Chem. Soc., 64, 80 (1942).

22767. Hennion, G. F., Auspos, L. A., J. Amer. Chem. Soc., 65, 1603 (1943).

22773. Lowry, T. M., J. Chem. Soc., 105, 81 (1974).

22774. DeWilde, J. H., Z. Anorg. Chem., 233, 411 (1937).

22775. Kato, M., Watarai, H., Suzuki, N., Can. J. Chem., 55, 1473 (1977).

22784. Hennion, G. F., Kupiecki, F. P., J. Org. Chem., 18, 1601 (1953).

22785. Ross, J. D. M., Somerville, I. C., J. Chem. Soc., London, Trans., 129, 2770 (1926).

22810. Aihara, A., Nippon Kagaku Zasshi, 74, 631 (1953).

Table 20. Citations for literature documents--Continued

22860. Janik, J., Rocz. Chem., 37(7-8), 849 (1963).

22865. Despic, A. R., Kosanovic, Dj. R., Glas. Hem. Drus., Beograd, 28(1), 13 (1963).

22902. Eckstrom, H. C., Berger, J. E., Dawson, L. R., J. Phys. Chem., 64, 1458 (1960).

22903. Paranjpe, G. R., J. Indian Inst. Sci., 2, 47 (1918).

22906. Barraza, R., Diaz, S., Edwards, J., Tapia, P., Z. Phys. Chem., Neue Folge, 117, 43 (1979).

22974. Holemann, P., Hasselmann, R., Research Report Number 109, Minister of Transport and Economy, Nordrhein-Westfalen, West Germany, 1954.

22985. Bingham, E. C., Brown, D. F., Rheology, 3(1), 95 (1932).

23023. Gagnon, P. E., Hudon, R., Cantin, I., Ganas, J., Trans. Roy. Soc. Can., Sect. 3, (33), 47 (1939).

23080. Mousa, A. E. H. N., Ph.D. Dissertation, Ohio State University, Columbus, Ohio, 1970.

23109. Kreglewski, A., Bull. Acad. Pol. Sci., Ser. Sci. Chim., 11, 301 (1963).

23135. Amaya, K., Bull. Chem. Soc. Jap., 34(9), 1278 (1961).

23174. Chandak, B. S., Nageshwar, G. D., Mene, P. S., J. Chem. Eng. Jap., 9, 495 (1976).

23180. Chandak, B. S., Nageshwar, G. D., Mene, P. S., Can. J. Chem. Eng., 54, 647 (1976).

23246. Mueller, C. R., Kearns, E. R., J. Phys. Chem., 62, 1441 (1958).

23251. Errera, J., Sherrill, M. L., J. Amer. Chem. Soc., 52, 1993 (1930).

23270. Grolier, J.-P. E., Wilhelm, E., Hamedi, M. H., Ber. Bunsenges. Phys. Chem., 82, 1282 (1978).

Table 20. Citations for literature documents--Continued

23278. McMahon, E, M., Roper, J. N., Utermohlen, W. P., Jr., Hasek, R. H., Harris, R. C., Brant, J. H., J. Amer. Chem. Soc., 70, 2971 (1948).

23284. Komarewsky, V. I., Coley, J. R., J. Amer. Chem. Soc., 63, 3269 (1941).

23285. Greenwood, F. L., Whitmore, F. C., Crooks, H. M., J. Amer. Chem. Soc., 60, 2028 (1938).

23310. Foley, W. M., Welch, F. J., La Combe, E. M., Mosher, H. S., J. Amer. Chem. Soc., 81, 2779 (1959).

23313. Foster, R. E., Larchar, A. W., Lipscomb, R. D., McKusick, B. C., J. Amer. Chem. Soc., 78, 5606 (1956).

23353. Prakash, S., Sivanarayana, K., Prakash, O., Can. J. Chem., 58(9), 942 (1980).

23395. Robinson, R. L., Jr., Edmister, W. C., Dullien, F. A. L., Ind. Eng. Chem., Fundam., 5(1), 74 (1966).

23414. Lux, W. E., Ph.D. Dissertation, University of Wisconsin, Madison, Wisconsin, 1955.

40009. Mousa, A. H. N., J. Fluorine Chem., 8(1), 5 (1976).

40067. Lorimer, J. W., Smith, B. C., Smith, G. H., J. Chem. Soc., Faraday Trans. 1, 71, 2232 (1975).

40098. Rosso, J.-C., Canals, C., Carbonnel, L., C. R. Acad. Sci., 281(18), 699 (1975).

40113. Dyakiv, F. V., Zeliznyi, A. M., Shevchenko, E. F., J. Gen. Chem. USSR, 46(10), 2115 (1976).

40115. Glukhareva, M. I., Taravkova, E. N., Chashchin, A. M., Kushner, T. M., Serafimov, L. A., J. Gen. Chem. USSR, 49(3), 684 (1976).

40156. Prabhakara Rao, M. V., Naidu, P. R., J. Chem. Thermodyn., 8(1), 73 (1976).

40158. Prabhakara Rao, M. V., Naidu, P. R., J. Chem. Thermodyn., 8(1), 96 (1976).

Table 20. Citations for literature documents--Continued

40207. Voronkov, A. P., Mislavskaya, V. S., Mushii, R. Ya., Khodeeva, S. M., Russ. J. Phys. Chem., 49(12), 1848 (1975).

40217. Hopfner, A., Hostermann, I., Z. Phys. Chem. (Frankfurt am Main), 99(1-3), 157 (1976).

40222. DePablo, R. S., J. Chem. Eng. Data, 21(2), 141 (1976).

40228. Hafez, M., Hartland, S., J. Chem. Eng. Data, 21(2), 179 (1976).

40230. Wisniak, J., Tamir, A., J. Chem. Eng. Data, 21(2), 185 (1976).

40275. Peng, D.-Yu., Robinson, D. B., Ind. Eng. Chem., Fundam., 15(1), 59 (1976).

40284. Meyer, E. F., Hotz, C. A., J. Chem. Eng. Data, 21(3), 274 (1976).

40337. Wagner, W., Ewers, J., Pentermann, W., J. Chem. Thermodyn., 8(11), 1049 (1976).

40353. Subramanyam Reddy, K., Naidu, P. R., J. Chem. Thermodyn., 8(12), 1208 (1976).

40370. Hamam, S. E. M., Chung, W. K., Eishayal, I. M., Lu, B. C.-Y., Ind. Eng. Chem., Process Des. Develop., 16(1), 51 (1977).

40425. Prabhakara Rao, M. V., Naidu, P. R., Can. J. Chem., 54(14), 2280 (1976).

40489. Dusart, O., Piekarski, C., Piekarski, S., Viallard, A., J. Chim. Phys. Physicochim. Biol., 73(9-10), 837 (1976).

40566. Kiyohara, O., Benson, G. C., Grolier, J.-P. E., J. Chem. Thermodyn., 9(4), 315 (1977).

40642. Messow, U., Doye, U., Kuntzsch, S., Kuchenbecker, D., Z. Phys. Chem. (Leipzig), 258(1), 90 (1977).

40682. Boublik, T., Lu, B. C.-Y., J. Chem. Eng. Data, 22(3), 331 (1977).

40688. Grolier, J.-P., Kiyohara, O., Benson, G. C., J. Chem. Thermodyn., 9(7), 697 (1977).

Table 20. Citations for literature documents--Continued

40816. Gupta, A. C., Hanks, R. W., Thermochim. Acta, 21(1), 143 (1977).

40936. Diaz Pena, M., Crespo Colin, A., Compostizo, A., J. Chem. Thermodyn., 10(4), 337 (1978).

40979. Dielsi, D. P., Patel, R. B., Abbott, M. M., Van Ness, H. C., J. Chem. Eng. Data, 23(3), 242 (1978).

41041. Reddy, K. S., Naidu, P. R., J. Chem. Thermodyn., 10, 201 (1978).

41156. Sreenivasulu, M., Naidu, P. R., J. Chem. Thermodyn., 10(11), 1019 (1978).

41162. Diaz Pena, M., Crespo Colin, A., Compostizo, A., J. Chem. Thermodyn., 10(11), 1101 (1978).

41319. Urdaneta, O., Hamam, S., Handa, Y. P., Benson, G. C., J. Chem. Thermodyn., 11(9), 851 (1979).

41354. Maher, P. J., Smith, B. D., J. Chem. Eng. Data, 24(4), 363 (1979).

41379. Takeo, M., Nishii, K., Nitta, T., Katayama, T., Fluid Phase Equilibria, 3(2-3), 123 (1979).

41407. Reddy, K. S., Naidu, P. R., Aust. J. Chem., 32(3), 687 (1979).

41430. Kato, M., Ind. Eng. Chem., Fundam., 19, 253 (1980).

41522. Chaudhry, M. M., Van Ness, H. C., Abbott, M. M., J. Chem. Eng. Data, 25(3), 254 (1980).

41545. Maher, P. J., Smith, B. D., J. Chem. Eng. Data, 25(1), 61 (1980).

41586. Apelblat, A., Tamir, A., Wagner, M., Fluid Phase Equilibria, 4, 229 (1980).

41622. Rigglo, R., Ubeda, M. H., Ramos, J. F., Martinez, H. E., J. Chem. Eng. Data, 25(4), 318 (1980).

41648. Dymond, J. H., Smith, E. B., "The Virial Coefficients of Pure Gases and Mixtures", Oxford University Press, New York, 1980.

Table 20. Citations for literature documents--Continued

41661. Roddy, J. W., Ind. Eng. Chem., Process Des. Develop., 20(1), 104 (1981).

41685. Olson, J. D., J. Chem. Eng. Data, 26(1), 58 (1981).

41759. Loehe, J. R., Van Ness, H. C., Abbott, M. M., J. Chem. Eng. Data, 26(2), 178 (1981).

41765. Ambrose, D., National Physical Laboratory Report, CHEM 107, Teddington, Middlesex, England, February, 1980.

NBS-114A (REV. 2-8C)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET (See instructions)	1. PUBLICATION OR REPORT NO. NBSIR 84-2811	2. Performing Organ. Report No.	3. Publication Date January 1984

4. TITLE AND SUBTITLE

Definition of Recommended Values of Certain Thermodynamic Properties for the Ketones

5. AUTHOR(S)

Buford D. Smith and Ol Muthu

6. PERFORMING ORGANIZATION (If joint or other than NBS, see instructions)

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

7. Contract/Grant No.

8. Type of Report & Period Covered

9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP)

10. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

Experimental data for the vapor pressure, liquid density, second virial coefficient, and certain compound constants for the ketones were retrieved in a comprehensive sweep of the literature. The vapor pressure and liquid density data were subjected to an intensive selection-deletion process to identify the best available experimental data points for each compound. Those data were carefully correlated with reliable equations in order to put the selected data into a form convenient for use in computer data banks. The second virial coefficient data were not subjected to such an intensive evaluation process; that predictive correlation equation which provided the best overall representation of the literature data sets for each compound was chosen for use in the data bank. Values of the compound constants were selected subject to the requirement that those constants related to the vapor pressure and liquid density be consistent with the selected correlations for those properties. Whenever possible, the parameters for the best available equations of state are provided. The correlation equations can be used to provide tabulations of vapor pressure, saturated liquid density, second virial coefficients, heat of vaporization, and saturated vapor volume to the extent permitted by the available good experimental data.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

Critical properties; data evaluation; equation of state; ketones; liquid density; literature retrieval; melting point; normal boiling point; property correlation; second virial coefficient; selected data; vapor pressure

13. AVAILABILITY

☐ Unlimited

☐ For Official Distribution. Do Not Release to NTIS

☐ Order From Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

☒ Order From National Technical Information Service (NTIS), Springfield, VA. 22161

14. NO. OF PRINTED PAGES

168

15. Price

$16.00