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A REVIEW OF PULSE-COLUMN FLOODING DATA AND CORRELATIONS WITH PROPOSED METHODS OF CORRELATION

R. A. McAllister

A. D. Ryon

MASTER

ABSTRACT

The report details the progress made in assembling available unclassified flooding data in perforated-plate pulsed extraction columns through January 1, 1963. Existing correlations are critically reviewed and recommendations are made to develop a better flooding correlation.

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INTRODUCTION

This report details the progress made in assembling available information on flooding in perforated-plate pulsed extraction columns through January 1, 1963. The purpose of the study was to review critically existing correlations and to develop more accurate methods for predicting flooding in perforated-plate pulse columns. While it is recognized that the literature survey which was made was incomplete, it is felt that the majority of the major sources of information have been collected and assembled. The outstanding exception is the vast amount of flooding data which appears only in the classified literature. The work of Hamilton⁴⁵ is also not included in the data tables of this report, but will be included in subsequent calculations. In order to carry this study further, this important source must be exploited. Most of the data that were collected are listed on IBM Data cards, a listing of which is enclosed in the Appendix. Several suggestions are offered for treating the data. Much remains that can be done with the data, but the most significant accomplishment that can be reported at this time is the data assembly itself.

Flooding Phenomena. The pulse column which is the subject of this study is a liquid-liquid extraction apparatus containing several stages formed by the insertion of perforated plates inside a vertical column. Immiscible liquids are fed continuously into the column and pass countercurrently. Usually a solute is being transferred from one phase into the other, but there are much data in which there is no mass transfer, i.e., the phases are in equilibrium. The latter data are usually obtained in the course of determining the ranges of operation of the column including information on flooding. Geier³⁹ reports five separate regions of pulse column operating behavior. Two of the regions are classified as flooding--one due to insufficient pulsation, and the other results from emulsion flooding.

To describe the first type of flooding, consider a pulse column in which an aqueous phase is continuous. Assume that the organic phase is dispersed and that it is less dense than the aqueous phase. For this

case the organic phase would be fed into the bottom of a simple column, while the aqueous phase would be fed into the top of the column. The organic phase rises to the bottom of the first plate. Normally the perforations in the plate are small enough so that the organic phase cannot pass through the plate by the force of gravity due to the density difference between the phases. If then there is insufficient pulsing to force the organic phase up through the plates (and aqueous phase down through the plate on the return stroke of the pulse), organic phase will back up in the bottom section and be forced out in the aqueous stream. This type of flooding could occur either at the top or bottom of the column, regardless of which phase was continuous and is called flooding due to insufficient pulsing.

Flooding due to emulsification occurs at higher rates of pulsing. The increased turbulence caused by more frequent and/or higher amplitude pulsing results in formation of a dispersion which is much like a stable emulsion. The dispersion is sufficiently stable so that there is insufficient time for the two phases to separate completely in the ends of the column. Usually what happens in the case described above is that the emulsion "backs up" in the column and again passes out the bottom of the column with the continuous phase.

There are at least four other types of flooding. Defives²⁶ describes one of these types which occurs in the absence of mass transfer. Another type of flooding in which mass transfer was occurring is described by Lowrie⁹⁶ in a compound column 24 ft tall which was fed 12 ft from the top of the column. Two still different types of flooding were described by McEachern⁶⁷ in the region of flooding due to insufficient pulsation.

It is doubtful that all the operating regions of the pulse column have been explored or reported.

Some Problems. One of the biggest problems involved in attempting to correlate data on flooding is in the definition of flooding itself. Most of the flooding data reported in the literature are the result of a visual observation by the experimenter. It is almost inevitable that differences exist among investigators in what is labeled flooding. In

certain systems investigators³⁹ have reported an unstable zone of operation which indistinctly fades into a flooding region. This would imply a "range" of incipient flooding, rather than a distinct boundary between flooding and stable operation. Other investigators^{73,74} report no hysteresis at all, and are able to approach the flooding point from any direction. It is apparent that with some systems it is more difficult to detect flooding than with others, but as long as a visual observation is the criterion for the definition of flooding there will be an uncertainty in defining the flooding point. Perhaps the best solution to this problem was reported by McNamee.³³ The volume fraction of the dispersed phase, i.e., the holdup, is measured at a given set of operating conditions. Holdup measurements are made after 30 min of steady-state operation. The measurement is repeated after, say, 60 min of operation. If the two holdup readings agree, the flooding region has not yet been reached. If the 60-min reading gives a significantly higher reading, then the flooding point has been passed. If one plots holdup versus pulse frequency (holding flow rates and pulse amplitude constant), the flooding point will be defined by the frequency at which the 30-min-holdup curve diverges from the 60-min-holdup curve.

Another problem which one faces in attempting to correlate existing flooding data is that the data often are incomplete. Data on the physical properties of the systems used are frequently missing. For much of the data reported here physical property measurements were made in the laboratory by mixing the solutions to the compositions reported in the literature and taking measurements on these solutions. Such a procedure is not entirely satisfactory since small differences in composition may make a great difference in some of the properties measured. A striking example of this is the interfacial tension of the n-heptane-water system used by Defives and Durandet.²⁶ The latter report the surface tension to be 33.6 dynes/cm, while the accepted value^{27,47} is 50.5 ± 0.4 . Hu⁵² reports an interfacial tension of 41 dynes/cm for the same system.

Another major problem in correlating flooding data is that it is not yet known what the important variables are, and how to characterize or measure them. Plate wetting, coalescence, and mass transfer are all

known to affect the flooding point. Dispersed-phase holdup is another possibility for an important variable. While all these factors are undoubtedly related, it is not known what the relationship is. Edwards³⁰ and Pike⁷⁴ both report that for high-purity systems in which there is no mass transfer, small traces of grease contamination can make a difference as much as a factor of four in the flooding rate.

LITERATURE SURVEY

Excellent reviews^{2,65} have appeared recently covering the general subject of the use of pulse columns in solvent extraction. Both reviews include the study of the literature on flooding. Flooding due to insufficient pulsations can be predicted with confidence by the equation of Edwards and Beyer.³¹ The equation does not predict, however, the point at which one passes from flooding due to insufficient pulsing to the region of emulsion flooding. Most of the discussion which follows is concerned with emulsion-type flooding. Any generally useful correlation must be applicable to all types of flooding.

Swift's Correlation. Swift⁸⁷ proposed the first important correlation which relates the effect of cartridge geometry, pulse characteristics and volume flow variables in the region of emulsion type flooding. The equation is empirical and does not include the physical properties of the system used. Swift suggests that the two constants in the equation contain the effect of physical properties of the system. The correlation is:

$$\log \left[\frac{(V_C + V_D) \epsilon^{0.34}}{d^{0.64}} \right] = C_1 - C_2 \frac{FA_d^{0.28}}{S^{0.28} \epsilon^{0.82}}$$

All of the symbols in the equation are defined in the section on Nomenclature. The quantities C_1 and C_2 are dimensional constants which are functions of the physical properties of the system. Claybaugh¹⁹ shows how Swift's equation can be combined with one using the dimensional analysis approach, for example, Thornton's Equation, or Smoot and Babb's Equation given below. This is one way the constants may be related to the physical properties of the systems studied.

Thornton's Correlation. Thornton^{64,90} reports an extensive study in which six organic-aqueous systems, eleven column cartridges and six columns of different dimension were studied both for flooding and mass-transfer characteristics. Thornton's correlation for flooding uses the characteristic droplet velocity, $\bar{V}_0$, derived from a consideration of the theory of hindered settling,

$$\left(\frac{\bar{V}_0 \mu_C}{\gamma} \right) = 0.60 \left(\frac{\Psi_f \mu_C^5}{\rho_C \gamma^4} \right)^{-0.24} \left(\frac{d \rho_C \gamma}{\mu_C^2} \right)^{0.90} \left(\frac{\mu_C^4 g}{\Delta \rho \gamma^3} \right)^{1.01} \left(\frac{\Delta \rho}{\rho_C} \right)^{1.80} \left(\frac{\mu_D}{\mu_C} \right)^{0.30}$$

Smoot and Babb's Correlation. Smoot and Babb⁸³ combined the data of Swift,⁸⁷ Thornton,^{64,90} Pike,^{73,74,75} and Cohen and Beyer²² into another equation derived from dimensional analysis as follows:

$$\frac{(V_C + V_D) \mu_C}{\gamma} = 0.527 \left(\frac{V_C}{V_D} \right)^{-0.14} \left(\frac{\Delta \rho}{\rho_C} \right)^{0.63} \left(\frac{\Psi_f \mu_C^5}{\rho_C \gamma^4} \right)^{-0.207} \left(\frac{d \gamma \rho_C}{\mu_C^2} \right)^{0.458} \left(\frac{D}{d} \right)^{0.000} \\ \times \left(\frac{g \mu_C^4}{\rho_C \gamma^3} \right)^{0.81} \left(\frac{\mu_D}{\mu_C} \right)^{-0.20}$$

It will be noticed that nearly all of the dimensionless groups on the right-hand side of the equation are identical with those Thornton used. One difference of note is worth mentioning here. In the term $(g \mu_C^4 / \rho_C \gamma^3)$ used by Smoot and Babb, the density is in terms of the density of the continuous phase. In Thornton's equation $\Delta \rho$ is used in the denominator instead of ρ_C . It is not known at this time which expression is preferable since dimensionally one is as good as the other. Plans are under way to examine this point specifically to determine the better combination (see below).

Baillie's Correlation. Baillie^{3,4} pointed out that the range of physical properties used by Thornton, and Smoot and Babb was not large, especially for the continuous phase. Baillie then determined emulsion flooding data over a much wider range of properties of the two phases.

For a 1.00-in. column using a 1.94-in. spacing, 70 cycles/min pulse, with plates having a hole diameter of 0.111 in. and free area of 0.230, Baillie derived the following equation:

$$\frac{(V_C + V_D)\mu_C}{\gamma} = 0.165 \left(\frac{\mu_D}{\mu_C} \right)^{0.36} \left(\frac{\Delta\rho}{\rho_C} \right)^{0.32} \left(\frac{\mu_C^4 g}{\rho_C \gamma^3} \right)^{0.21}$$

Notice that Baillie's characteristic of flooding, the left-hand side of the equation, is the same as Smoot and Babb's. Baillie also used the ρ_C in the denominator of the fourth term on the right-hand side instead of $\Delta\rho$.

Discussion. One may compare the last three correlations in the following way. Table 1 shows a comparison of the range of variables

Table 1. Comparison of the Range of Variables

Variable	Range		
	Baillie (1961)	Smoot and Babb (1959)	Thornton (1958)
μ_C	1.9-10.6 centipoises	1.00 centipoise	1.06 centipoises
μ_D	1.1-5.6 centipoises	0.486-1.32 centipoises	0.486-0.928 centipoise
ρ_C	1.13-1.37 g/cm ³	1.00 g/cm ³	0.996-0.998 g/cm ³
ρ_D	0.773-0.887 g/cm ³	0.772-0.905 g/cm ³	0.772-0.905 g/cm ³
$\Delta\rho$	0.302-0.593 g/cm ³	0.0903-0.0307 g/cm ³	0.0903-0.307 g/cm ³
γ	8.9-15.8 dynes/cm	8.5-40 dynes/cm	8.5-40.0 dynes/cm
A	0.500 in.	0.104-0.500 in.	0.14-0.87 in.
F	70 cpm	14.5-420 cpm	90-420 cpm
D	1.000 in.	1.92-12 in.	2.78-12 in.
d	0.111 in.	0.0625-0.125	0.0625-0.125
L	12 ft	3-9 ft	3-9 ft
ϵ	0.230	0.081-0.62	0.131-0.621
S	1.94 in.	0.500-3.00 in.	0.500-3.00 in.

involved. Notice that in the correlations of Smoot and Babb and of Thornton, the physical properties of the continuous phase are not varied significantly. Baillie's data cover a much higher range of viscosity of both phases, but other variables have a smaller range. It is apparent that all the data used by these investigators and all other available data need to be combined into a single equation. Another comparison which may be made is shown in Table 2. Here the net exponents of various

Table 2. Comparison of Exponents

Variable	Net Exponent			Comment
	Baillie	Smoot and Babb	Thornton	
$\Delta\rho$	+0.32	+0.63	+0.79	
ρ_C	-0.53	-0.675	-0.66	
ρ_D	-	-	-	(In $\Delta\rho$ only)
μ_C	-0.52	+0.49	-0.26	
μ_D	+0.36	-0.20	+0.30	
γ	+0.37	-0.144	-0.17	
F	-	-0.621	-0.72	
A	-	-0.621	-0.72	
V_C/V_D	-	+0.014	-	(V_C, V_D in flooding capacity)

physical properties are shown for each correlation. Such a comparison is not particularly useful, since the equations and the flooding characteristic are somewhat different, and of course the range of variables is not the same. The table does illustrate the dilemma one faces in trying to choose a suitable equation to predict flooding.

PIKE'S DEVELOPMENT OF FLOODING THEORY

Theoretical Development. The most important contribution to the Theory of Flooding was made by Pike.^{73,74,75} In his own words⁷⁵ " . . . An intensive study of the available pulse-column flooding data on two binary systems has led to the evolution of a theoretical picture of

flooding behavior, and the demonstration that the equations thus derived aid greatly in expressing and interpreting flooding data on binary systems.

"Reliance was placed mainly on the flooding data for the benzene-water system,⁷⁴ with auxiliary use being made of the data on trichloroethylene-water.⁷³ Ideas concerning suitable ways of expressing and relating flooding capacity were derived by dimensional analysis, intuition and a detailed analysis of the flow patterns within a pulse column. These ideas were tested by a mathematical procedure previously developed, and evaluated by means of a statistical criterion called the F statistic. The use of this F statistic served to evaluate one idea as better or worse than another and thus to point towards the more pertinent concepts."

Pike realized that understanding of the flooding phenomenon depended on proper grouping of the variables, which depends directly on a theoretical foundation. To aid in the development of the theory, full use was made of the statistical procedure called analysis of variance. To begin with, the flooding data for the benzene-water system were taken in a systematic way using an experimental design called the cube-octahedron-cuboctahedron. This design calls for a regular spacing of the variables, and also requires replication of each data point so that an accurate estimate of the experimental error may be evaluated.

With a given column and a given liquid-liquid system the primary operating variables are F , A , V_D , V_C , and the shape of the pulse wave itself. In all of Pike's work the pulse was almost sinusoidal,* and in all the equations given below a sinusoidal pulse was taken. It is possible, however, by graphical integration to incorporate any pulse shape into Pike's equations.

*In conversation with Dr. Pike, he pointed out that all of his results and data needed a slight correction since the pulse was measured to be not exactly sinusoidal. By the use of the integrals shown in reference⁷⁵ it will be possible to make this correction by performing a graphical integration.

Flooding capacity can be characterized in several ways.* If C is the flooding capacity one may write

$$C = (V_D + V_C)$$

$$C = \frac{FA}{V_D}$$

$$C = \frac{V_D + V_C}{FA}$$

$$C = \log (V_D/FA)$$

$$C = \frac{V_D}{FA}$$

$$C = \log \left(\frac{V_D}{\Pi_D} \right)$$

$$C = \frac{V_D}{\Delta_D}$$

$$C = \log \left(\frac{V_D}{\Delta_D} \right)$$

Among the various possible formulations of the relationships between C and the operating variables are these:

$$C = f (AF, A, V_D/V_C),$$

$$C = f (A, F, V_D/V_C),$$

$$C = f (\log A, F, V_D/V_C),$$

$$C = f (\log FA, \log A, \log V_D/V_C),$$

$$C = f (\log \Pi_D, \log A, \log V_D/V_C),$$

$$C = f [\log (\Delta_D/FA), \log (V_C/FA), \log (V_D/V_C)],$$

and so on. Obviously one might write a very large number of such equations. Note, however, that the use of $\log F$ instead of F can lead to quite different relative importance of high and low values of F . The choice of three independent or operating variables was arbitrary. The use of (V_D/V_C) as an independent variable by Pike instead of V_D , V_C , $(V_D + V_C)$, or some other expression was partly intuitive and partly based on his success of using the flow rate ratio as a primary operating variable in an earlier report.⁷³

The next step is the selection of the particular function to fit the equation $C = f (X_1, X_2, X_3)$. In the absence of a theoretical relationship among the variables, an arbitrary relationship among the variables could be assumed. For example a second or third degree polynomial might

*Much of the discussion which follows was taken directly from Ref. 75.

be chosen. The expression Pike selected was a Taylor series of the following form:

$$C = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_{11}X_1^2 + b_{22}X_2^2 + b_{33}X_3^2 + b_{12}X_1X_2 \\ + b_{13}X_1X_3 + b_{23}X_2X_3 + b_{222}X_2^3.$$

Once the functional form of the equation was selected the coefficients of the equation could then be determined by the method of least squares. Then an analysis of variance was made for each definition of C and X_1 , X_2 , and X_3 . The powerful feature of this analysis was the calculation of the lack of fit of the equation to the data, and the ratio of this lack of fit to the experimental error. This ratio, called the F statistic, was taken as a measure of the combined ability of the definitions employed adequately to express the observed flooding behavior. If the equation fits the data within the experimental error of those data, the F statistic would be 1.000. The larger the F statistic the poorer does the equation fit the data.

Briefly, by this means it was possible to show that the best fit of the data was obtained using the following form of the flooding equation:

$$C = \log \frac{100 V_D}{\Delta_D}, \quad X_2 = \log \Pi_D, \\ X_1 = \log A, \quad X_3 = \log (V_D/V_C),$$

resulting in the following equation

$$C = \log \frac{100 V_D}{\Delta_D} = 4.826373 + 0.680200 \log A - 0.063354 (\log A)^2 \\ - 4.338677 \log \Pi_D + 2.419305 \log (\Pi_D)^2 \\ - 0.479592 \log (\Pi_D)^3 - 0.333357 \log (V_D/V_C) \\ - 0.241265 \log (V_D/V_C)^2 - 0.266134 (\log A) (\log \Pi_D) \\ - 0.000575 (\log A) \log (V_D/V_C) \\ + 0.212904 (\log \Pi_D) \log (V_D/V_C).$$

One of the most interesting facts resulting from the analysis of variance is that the test of a third order form of the Taylor series, as shown below, did not significantly improve the F statistic or the degree of fit.

$$C = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_{11}X_1^2 + b_{22}X_2^2 + b_{33}X_3^2 \\ + b_{12}X_1X_2 + b_{13}X_1X_3 + b_{23}X_2X_3 + b_{111}X_1^3 + b_{222}X_2^3 \\ + b_{333}X_3^3 + b_{112}X_1^2X_2 + b_{122}X_1X_2^2 + b_{113}X_1^2X_3 \\ + b_{133}X_1X_3^2 + b_{223}X_2^2X_3 + b_{233}X_2X_3^2 + b_{123}X_1X_2X_3 .$$

Dimensional Analysis. Dimensional analysis has long been a useful tool to aid in the grouping of variables. In general it is more effective when it is assisted by a parallel theoretical analysis. The statistical development described above therefore points the way toward a more effective use of dimensional analysis. Pike suggested the following two equations to correlate flooding data:

$$\frac{V_D}{FA} = b_0 \left(\frac{V_D}{V_C} \right)^{b_1} \left(\frac{A}{S} \right)^{b_2} \left(\frac{dV_D \rho_D}{\mu_D} \right)^{b_3} \left(\frac{dV_C \rho_C}{\mu_C} \right)^{b_4} \left(\frac{d}{D} \right)^{b_5} \left(\frac{\Delta p}{\rho_C} \right)^{b_6} \left(\frac{\mu_D}{\mu_C} \right)^{b_7} \left(\frac{\rho_D V_D^2 d}{\gamma} \right)^{b_8} \\ \times \left(\frac{V_D^2 \rho_D}{g A \Delta p} \right)^{b_9} ,$$

$$\text{and } \frac{V_D}{\Delta_D} = a_0 \left(\frac{V_D}{V_C} \right)^{a_1} \left(\frac{A}{S} \right)^{a_2} \left(\frac{d \Pi_D \rho_D}{\mu_D} \right)^{a_3} \left(\frac{d \Pi_C \rho_C}{\mu_C} \right)^{a_4} \left(\frac{d}{D} \right)^{a_5} \left(\frac{\Delta p}{\rho_C} \right)^{a_6} \left(\frac{\mu_D}{\mu_C} \right)^{a_7} \\ \times \left(\frac{\rho_D \Pi_D^2 d}{\gamma} \right)^{a_8} \left(\frac{\Pi_D^2 \rho_D}{g A \Delta p} \right)^{a_9} .$$

It is expected that the second of these equations would give a much better fit to the data than the first. This follows from the fact that (V_D/Δ_D) , for example was shown to be a much better expression for fitting the data than (V_D/FA) .

One observation is pertinent in regard to these two equations. First of all the two equations are much different from those used by Smoot and Babb, Thornton, and Baillie. Smoot and Babb used the groups

(V_D/V_C) , (d/D) , $(\Delta\rho/\rho_C)$, and (μ_D/μ_C) . Other forms of the dimensionless groupings are much different. In Pike's equations one recognizes the Reynolds number, $(dV_D\rho_D/\mu_D)$; the Froude number, $(V_D^2\rho_D/A\Delta\rho)$; and the Weber number, $(\rho_D V_D^2 d/\gamma)$. These quantities have proven useful in a variety of hydrodynamical phenomena and it is a little surprising that they have not been used in flooding correlations, especially since they were suggested in 1955.⁷⁵

RECOMMENDATIONS

At the present time a large amount of flooding data have been collected. It has been possible to do only a small amount of calculation with a part of the data collected. There follows an outline of a suggested program of analysis of the data. As with any developmental program, the development itself will suggest changes in the course of action as the program progresses, but at the present time at least the following is indicated.

Taylor Series Equation. It is recommended that Pike's equation using the Taylor's series expansion be developed still further. As an example of the type of development involved, the following results are offered. Five forms of the equation were tested using Pike's benzene-water data.⁷⁴

$$C = f(X_1, X_2, X_3) ,$$

and the following model was used

$$C = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_{11}X_1^2 + b_{22}X_2^2 + b_{33}X_3^2 \\ + b_{12}X_1X_2 + b_{13}X_1X_3 + b_{23}X_2X_3 + b_{222}X_2^3 .$$

$$\text{Case I,} \quad C = \log (100 V_D/\Delta_D) ,$$

$$X_1 = \log A ,$$

$$X_2 = \log \Pi_D ,$$

$$X_3 = \log V_D/V_C ,$$

$$F \text{ statistic} = 1.62^*$$

*Footnote at bottom of next page.

Case II, $C = \log (100 V_D/\Delta_D) ,$
 $X_1 = \log (V_D/V_C) ,$
 $X_2 = \log A ,$
 $X_3 = \log \Pi_D ,$ F statistic = 4.69 .

Case III, $C = \log (100 V_D/\Delta_D) ,$
 $X_1 = \log \Pi_D ,$
 $X_2 = \log (V_D/V_C) ,$
 $X_3 = \log A ,$ F statistic = 5.00 .

Case IV, $C = \log (100 V_D/\Delta_D) ,$
 $X_1 = \log A ,$
 $X_2 = \log \Pi_{ave} ,$
 $X_3 = \log (V_D/V_C) ,$ F statistic = 1.55 .

Case V, $C = \log (100 V_D/\Delta_D) ,$
 $X_1 = \log A ,$
 $X_2 = \log \Pi_C ,$
 $X_3 = \log (V_D/V_C) .$ F statistic = 6.25 .

Case I is identical to Pike's original. Examination of the equation shows that it is entirely symmetrical in X's except for the term $b_{222}X_2^3$. Case II and Case III are seen merely to be permutations of the X's to show the effect of the cubical term on the goodness of fit. Case IV uses Π_{ave} instead of Π_D as the flow rate characteristic, and Case V uses Π_C instead of Π_D . Notice that the F statistics for Cases II, III and V are considerably poorer, but that the F statistic for Case III is somewhat better. It is difficult to say whether the improvement

*Pike shows a value of 1.82 for this F statistic for Case I. At the present time it is not known what causes the difference in this number. It is suspected that some of the data used in calculating the F statistic of 1.62 are incorrect. An attempt will be made to reconcile these two numbers.

indicated by Case III is significant, or whether it is accidental. Examination of the same form of the equations for Cases I and III, using a number of other people's data may indicate whether the Π_{ave} is indeed an improvement over Π_D .

Ultimately it would be desirable to incorporate into a single equation all of the variables having to do with column dimensions and physical properties of the system. For example, it might be possible to derive an equation of the following sort

$$C = f(X_1, X_2, X_3, \text{ and } X_4) ,$$

where

$$C = \ln(V_D/\Delta_D) ,$$

$$X_1 = \ln(A/S) ,$$

$$X_2 = \ln(\Pi_{ave}/\epsilon) ,$$

$$X_3 = \ln(V_D/V_C) ,$$

$$X_4 = \ln(nd/D + d_S) ,$$

then

$$\begin{aligned} C = & b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_{11}X_1^2 + b_{22}X_2^2 + b_{33}X_3^2 \\ & + b_{44}X_4^2 + b_{12}X_1X_2 + b_{13}X_1X_3 + b_{23}X_2X_3 + b_{24}X_2X_4 + b_{34}X_3X_4 \\ & + b_{222}X_2^3 . \end{aligned}$$

Incorporation of the column dimensions shown would not affect the goodness of fit of the equation in four independent variables with, say, the benzene-water data used above. For that system ϵ , S , and $nd/(D + d_S)$ are all constants. It may be possible to derive a single Taylor series equation in three or four variables which will fit the data for a given system regardless of the column dimensions. The next step would be to examine the constants b_0 , b_1 , ----, b_{222} to discern or derive their relation to the physical properties of the systems. The latter procedure would probably necessitate launching an experimental program designed to cover a suitable range of variables since at the present time there are only a few systems with sufficient data of the type needed to derive the constants b_0 , b_1 , ----, b_{222} .

Dimensional Analysis. A great deal more flooding data covering a wider range of variables is available than was used by Thornton, Smoot and Babb, or Baillie in their analyses. Considerable improvement on the goodness of fit could be effected simply by rederiving their equations using more data. This of course implies that the data currently available are good and that the equations used are adequate to describe the data. Pike's dimensional analysis equations should also be evaluated and compared with Thornton's, and Smoot and Babb's.

Specifically, the following procedure is recommended. Begin first with all the data in which no mass transfer is occurring, the aqueous phase is continuous, and metal perforated plates (excluding nozzle plates) are used. Fit these data to the following equations:

$$1. \left(\frac{\bar{V}_0 \mu_C}{\gamma} \right) = a_0 \left(\frac{\psi_f \mu_C^5}{\rho_C \gamma^4} \right)^{a_1} \left(\frac{d \rho_C \gamma}{\mu_C^2} \right)^{a_2} \left(\frac{\mu_C^4 g}{\Delta \rho \gamma^3} \right)^{a_3} \left(\frac{\Delta \rho}{\rho_C} \right)^{a_4} \left(\frac{\mu_D}{\mu_C} \right)^{a_5},$$

$$2. \left(\frac{(V_C + V_D) \mu_C}{\gamma} \right) = b_0 \left(\frac{\psi_f \mu_C^5}{\rho_C \gamma^4} \right)^{b_1} \left(\frac{d \rho_C \gamma}{\mu_C^2} \right)^{b_2} \left(\frac{\mu_C^4 g}{\Delta \rho \gamma^3} \right)^{b_3} \left(\frac{\Delta \rho}{\rho_C} \right)^{b_4} \left(\frac{\mu_D}{\mu_C} \right)^{b_5} \left(\frac{V_D}{V_C} \right)^{b_6} \left(\frac{d}{D} \right)^{b_7}$$

$$3. \left(\frac{(V_C + V_D) \mu_C}{\gamma} \right) = c_0 \left(\frac{\psi_f \mu_C^5}{\rho_C \gamma^4} \right)^{c_1} \left(\frac{d \rho_C \gamma}{\mu_C^2} \right)^{c_2} \left(\frac{\mu_C^4 g}{\rho_C \gamma^3} \right)^{c_3} \left(\frac{\Delta \rho}{\rho_C} \right)^{c_4} \left(\frac{\mu_D}{\mu_C} \right)^{c_5} \left(\frac{V_D}{V_C} \right)^{c_6} \left(\frac{d}{D} \right)^{c_7}$$

$$4. \left(\frac{V_D}{FA} \right) = g_0 \left(\frac{V_D}{V_C} \right)^{g_1} \left(\frac{A}{S} \right)^{g_2} \left(\frac{d V_D \rho_D}{\mu_C} \right)^{g_3} \left(\frac{d V_C \rho_C}{\mu_C} \right)^{g_4} \left(\frac{d}{D} \right)^{g_5} \left(\frac{\Delta \rho}{\rho_C} \right)^{g_6} \left(\frac{\mu_D}{\mu_C} \right)^{g_7}$$

$$\times \left(\frac{\rho_D V_D^2 d}{\gamma} \right)^{g_8} \left(\frac{V_D^2 \rho_D}{g A \Delta \rho} \right)^{g_9}$$

$$5. \left(\frac{V_D}{\Delta_D} \right) = h_0 \left(\frac{V_D}{V_C} \right)^{h_1} \left(\frac{A}{S} \right)^{h_2} \left(\frac{d \Pi_D \rho_D}{\mu_D} \right)^{h_3} \left(\frac{d \Pi_C \rho_C}{\mu_C} \right)^{h_4} \left(\frac{d}{D} \right)^{h_5} \left(\frac{\Delta \rho}{\rho_C} \right)^{h_6} \left(\frac{\mu_D}{\mu_C} \right)^{h_7} \times$$

$$\times \left(\frac{\rho_D \Pi_D^2 d}{\gamma} \right)^{h_8} \left(\frac{\Pi_D^2 \rho_D}{g A \Delta p} \right)^{h_9}$$

Equation 1 will be recognized as the ones used by Thornton. Equation 3 is that used by Smoot and Babb. Equation 2 is the same as 3, except for the use of Δp in the third term on the right-hand side of the equation instead of ρ_C . By analyzing the results from equations 2 and 3 it may be possible to tell which is the better grouping. Equations 4 and 5 are those suggested by Pike. What is needed now is a means of deciding which of the above equations fit the data the best. A conventional analysis of variance is not possible since for the vast majority of the data there is no way to estimate the experimental error. That is to say, there is almost no replication of data, or repetition of a run at a given set of experimental conditions. Pike's^{73,74} trichloroethylene-water data and his benzene-water data both report replication and it is therefore possible to calculate an estimated standard deviation, or estimated mean square residual, for V_D , for example, for these sets of data. Thornton⁶⁴ reports duplicate data for a sufficient number of runs to calculate another estimated mean square residual for V_D for his data. Aside from these two experimenters, there are only two^{28,68} who report any replication, and then only for one or two runs.

On the basis of what replicate runs there are, however, an estimated mean square residual for all the data will be assumed. With this assumed figure it will be possible to calculate an F statistic for the several equations outlined above. Then by comparing the F statistic for the several equations, it will be possible to select the groupings of variables which fit the data with the least amount of variance (i.e., give a better fit).

Such a practice, of assuming an experimental error, is a dangerous one, since the assumption may be considerably in error. If, however, the value chosen is a conservative one, then it is felt, the proposed technique of analysis will be useful.

Comparison of this quantity calculated from each of the five equations should indicate which equation seems to fit the data better and lead to an improved dimensional analysis.

Further development of the dimensionless equations proposed by Pike (Eqs. 4 and 5 above) might follow along the lines described below. Continue to use V_D/Δ_D since this quantity is an efficiency of pumping--it is the ratio of the actual flow rate of the discontinuous phase to the total pumping rate of material in the direction of flow of the discontinuous phase. Use the average velocity through the holes as the characteristic velocity in the Reynolds number terms, i.e. use (Π_D/ϵ) instead of Π_D and (Π_C/ϵ) instead of Π_C . The quantity Π_D is based on the flow rate in the column, while dividing by ϵ gives an average velocity through the holes. Instead of the ratio (d/D) , use $[nd/(D + d_g)]$. We now have a ratio of the perimeter of the holes to the wetted perimeter in between plates. This may be a reasonable way to take into account the number of holes in the column, a quantity not now in any correlation. The Froude number, $\Pi_D^2 \rho_D / g A \Delta \rho$, is the ratio of the pump accelerational forces to the gravitational forces on the droplet. Since these accelerational forces on the droplet are continuously on the droplet, and since the forces are higher through the holes than in the column, it may be better to replace Π_D^2 by $(\Pi_{ave}/\epsilon)^2$ in the Froude number.

The Weber number is the ratio of accelerational forces to interfacial tension forces. The accelerational forces are highest through the holes, therefore it is probably better to replace Π_D^2 in the term by $(\Pi_{ave}/\epsilon)^2$ since the accelerational forces are acting on the droplet in both directions. It is probably also appropriate to replace ρ_D by ρ_{ave} since the over-all average turbulence level through the holes, which would involve an "average" density of both phases, is probably more desirable than the turbulence of the discontinuous phase. The use of ρ_{ave} also brings into play the holdup x , which is probably an important independent variable which has not been used in any of the equations thus far. Intuition might predict that the kinematic viscosity is a more important variable than the absolute viscosity, hence one might replace (μ_D/μ_C) by (ν_D/ν_C) . Combining all these changes would result in

$$\frac{V_D}{\Delta_D} = a_0 \left(\frac{V_D}{V_C} \right)^{a_1} \left(\frac{A}{S} \right)^{a_2} \left(\frac{d\Pi_D}{\epsilon v_D} \right)^{a_3} \left(\frac{d\Pi_C}{\epsilon v_C} \right)^{a_4} \left(\frac{nd}{D + d_S} \right)^{a_5} \left(\frac{\Delta \rho}{\rho_C} \right)^{a_6} \left(\frac{v_D}{v_C} \right)^{a_7} \\ \times \left(\frac{\rho_D \Pi_{ave}^2 d}{\gamma \epsilon^2} \right)^{a_8} \left(\frac{\Pi_{ave}^2 \rho_{ave}}{g A \Delta \rho \epsilon^2} \right)^{a_9}$$

This equation could be compared quantitatively with the ones above, again by means of the F statistic. The density term using ρ_{ave} , which is a function of the holdup x could probably not be used since there is little experimental data reported which gives values for x at flooding. Thornton gives an equation which relates x at flooding to the flow rate ratio V_D/V_C , but there is evidence that the equation may not be universally true.⁹⁷ The term ρ_{ave} might be replaced by ρ_C (or perhaps ρ_D).

Generalized Correlation. There remains the task of accounting for the effects of mass transfer, plate-wetting properties of both phases, and coalescence. At the present time it appears necessary to fit an equation for each of the following conditions:

1. No mass transfer, aqueous phase continuous, metal plates,
2. No mass transfer, aqueous phase continuous, plastic plates,
3. No mass transfer, organic phase continuous, metal plates,
4. No mass transfer, organic phase continuous, plastic plates,
5. Mass transfer, aqueous phase continuous, metal plates,
6. Mass transfer, aqueous phase continuous, plastic plates,
7. Mass transfer, organic phase continuous, metal plates, and
8. Mass transfer, organic phase continuous, plastic plates.

Whether such a classification of the data will adequately account for the effects of mass transfer, plate wetting, etc., remains to be seen. A more detailed analysis of plate wetting and coalescence should be examined to see if theoretical developments can be made in these subjects. It may then be possible to reduce significantly the number of equations required.

Miscellaneous Recommendations. The literature survey should be completed and kept up-to-date as new data are published. Particular

attention should be directed toward use of data from classified reports. Steps should be taken to declassify these data where possible so that a broader variety of data, especially with mass transfer occurring, are brought to bear on all the correlations.

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NOMENCLATURE

$a_0, a_1, a_2 \dots$ etc. = constants

A = pulse amplitude in the column from the bottom of the stroke to the top of the stroke (ft)

$b_0, b_1, b_2 \dots$ etc. = constants

$c_0, c_1, c_2 \dots$ etc. = constants

c_0 = orifice coefficient = 0.60 in Thornton's equation

C_1, C_2 = dimensional constants

C = flooding capacity, variously expressed

d = diameter of perforations (ft)

d_s = outside diameter of the spacer (S) between the plates (ft)

D = inside diameter of column (ft)

F = pulse frequency (cycles/(minute))

g = the local acceleration of gravity (ft/hr²)

$g_0, g_1, g_2 \dots$ etc. = constants

$h_0, h_1, h_2 \dots$ etc. = constants

L = length of the column from the top plate to the bottom plate (ft)

n = number of perforations per plate

N = total number of perforated plates

S = plate spacing, the distance from the top face of a given plate to the bottom face of the plate above (in. or ft). Note: $S \approx L/(N - 1)$.

t = thickness of the plate (ft)

$$\Delta V = (V_D - V_C)$$

V_C = velocity of the continuous phase (cu ft/hr)
(sq ft column cross section less cross sectional area of spacers) (net units ft/hr)

V_D = velocity of the disperse phase (ft/hr)

$\bar{V}_0$ = characteristic droplet velocity (ft/hr)

$$= \frac{V_C}{(1 - x_f)^2} + \frac{V_D}{x_f(1 - x_f)}$$

x = holdup (volume fraction of the dispersed phase)

X_1, X_2, X_3 = independent variables

$$x_f = \text{holdup at flooding} = \frac{2}{3 + \sqrt{1 + 8 \frac{V_C}{V_D}}} \text{ for Thornton's}$$

correlation

Greek Letters

γ = interfacial tension between the continuous and the discontinuous phase (dynes/cm)

Δ_D = same flow quantity as for Π_D , but averaged as a rate over the entire pulse cycle, as in ft/hr. For a sine wave pulse
 $= FA\phi(\lambda) + \frac{\Delta V}{2} \Psi_P(\lambda)$

Δ_C = same flow quantity as for Π_C , but averaged as a rate over the entire pulse cycle, as in ft/hr. For a sine wave pulse.

$$= FA\phi(\lambda) - \frac{\Delta V}{2} [2 - \Psi_P(\lambda)]$$

ϵ = fractional free area, (total area of perforations)/(cross sectional area of the column, less area of spacers or tie rods inside column)

θ_C = the actual time that material is flowing past the plate in the direction of flow of the continuous phase per cycle

θ_D = the actual time that material is flowing past the plate in the direction of flow of the discontinuous phase per cycle

$$\lambda = \frac{-\Delta V}{\pi FA}$$

μ_C = absolute viscosity of the continuous phase (lb/ft hr)

μ_D = absolute viscosity of the disperse phase (lb/ft hr)

ν_C = kinematic viscosity of the continuous phase = μ_C/ρ_C

ν_D = kinematic viscosity of the discontinuous phase = μ_D/ρ_D

$$\pi = 3.1416 \dots$$

Π_{ave} = average flow rate of both phases in both directions, i.e. an average of Π_D and Π_C over the appropriate time intervals θ_D and θ_C

$$\Pi_{ave} = \frac{\Pi_D \theta_D + \Pi_C \theta_C}{\theta_D + \theta_C} = \frac{\Pi_D \theta_D + \Pi_C \theta_C}{(1/F)} = 2FA[(1 - \lambda^2)^{\frac{1}{2}} + \lambda \arcsin \lambda]$$

Π_C = average flow rate of the total material past the plates in the direction of the continuous phase flow, averaged over the actual time of flow in that direction, as in ft/hr = $\frac{2FA\phi(\lambda)}{[2 - \Psi_P(\lambda)]} - \Delta V$ for a sine wave pulse

Π_D = average flow rate of total material past the plates in the direction of the discontinuous phase flow, averaged over the actual time of flow in that direction, as in ft/hr = $\frac{2FA\phi(\lambda)}{\Psi_P(\lambda)} + \Delta V$ for a sine wave pulse

$\Delta\rho = |\rho_C - \rho_D|$, the absolute value of the density difference of the phases (lb/cu ft)

ρ_{ave} = average density of both phases = $\rho_C + (\rho_D - \rho_C) x$, where holdup is uniform throughout

ρ_C = density of the continuous phase (lb/cu ft)

ρ_D = density of the discontinuous phase (lb/cu ft)

$$\phi(\lambda) = [1 - \lambda^2]^{\frac{1}{2}}$$

Ψ_f = maximum frictional power absorbed per unit mass of fluid in the perforations in the sieve plates, sq ft/hr³ = $\frac{\Pi^2 N(1 - \epsilon^2) (FA)^3}{2\epsilon^2 C_0^2 L}$

for a sine wave pulse.

$$\Psi_P(\lambda) = [1 - \frac{2}{\pi} \arcsin \lambda]$$

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Table A-1. Supplementary Data

Data Point Number	Ref.	System		Column Height (ft)	Plate			Note
		Organic	Aqueous		Hole Pattern	Hole Space (in.)	Thickness	
1-111	3	5% TBP - kerosene	Al(NO ₃) ₃ - H ₂ O	12	Square	3/16	-	
112-191	90	White spirit	H ₂ O	3.5	-	-	16 swg	
192-363		Toluene	H ₂ O	3.5	-	-	16 swg	
364-377		Butyl acetate	H ₂ O	3.5	-	-	16 swg	
378-397		Methyl isobutyl ketone	H ₂ O	3.5	-	-	16 swg	
398-407		Iso-octane	H ₂ O	3.5	-	-	16 swg	
408-429		Ethyl acetate	H ₂ O	3.5	-	-	16 swg	
430-560		Toluene	H ₂ O	3.5	-	-	16 swg	c
561-605	64	Toluene	H ₂ O	3.0	Triangle	-	12 swg	a
606-640		White spirit	H ₂ O	3.0	Triangle	-	10 swg	a
641-692		Toluene	H ₂ O	6.0	Triangle	-	10 swg	a
693-719		5% acetone in Toluene	H ₂ O	6.0	Triangle	-	10 swg	a,f
720-773	74,75	Benzene	H ₂ O	4.0	Triangle	-	20 bwg	
774-798	73	Trichloroethylene	H ₂ O	4.0	Triangle	-	20 bwg	b
799-811	43	Methyl isobutyl ketone	1.9 g NiCl ₂ /liter, 0.354 g NH ₄ CNS/liter	12	-	-	0.020 in.	b
812-817	78,79	30% TBP - CCl ₄	2.4 M HNO ₃	9	-	-	-	b
818-828		30% TBP - CCl ₄ , 0.2 M HNO ₃	0.03 M HNO ₃	9	-	-	-	b
829-845	29	40% TBP - Petroleum (170 - 248°C)	0.1 M HNO ₃	3	-	-	-	b
846-850	104	Toluene + 0.79 g benzoic acid/liter	0.42 g benzoic acid/liter	3	-	-	-	b,c
851-852	85	Methyl isobutyl ketone	0.01 M FeCl ₃ , 0.37 M Al(NO ₃) ₃ , 2 M HCl	3	Staggered	33 holes	1/16 in.	b
853-855	28	40% TBP - Amsco + UO ₂ (NO ₃) ₂ to 0.845 density	H ₂ O	3 - 12	-	-	-	b
856-860		40% TBP - Amsco + UO ₂ (NO ₃) ₂ to 0.837 density	H ₂ O	3 - 12	-	-	-	b
867,874,875,879,883,887,891		10% TBP - Amsco	H ₂ O	3 - 12	-	-	-	b
861,864,868,871,876,880,884,888,892		20% TBP - Amsco	H ₂ O	3 - 12	-	-	-	b
862,865,869,872,877,881,885,889,893		30% TBP - Amsco	H ₂ O	3 - 12	-	-	-	b
863,866,870,873,878,882,886,890,894		40% TBP - Amsco	H ₂ O	3 - 12	-	-	-	b
895-906,911,912	68	35% TBP - Decalin	0.5 M Al(NO ₃) ₃	26	-	-	-	b
907-910		42.5% TBP - Amsco	0.5 M Al(NO ₃) ₃					
913-1090	87	Amsco 125-90W	H ₂ O	-	-	-	-	
1091-1100	50	42.5% TBP - Decalin	0.65 M Al(NO ₃) ₃	26	-	-	-	d
1101-1132	67	10 wt % acetone-Toluene	H ₂ O	-	-	-	14 B&S gage	b,e

^aStainless steel column; all others are glass.

^bIn certain data where no physical properties were reported, solutions were made up and the physical properties were measured at ORNL in 1962.

^cPulse wave—semisquare.

^dCompound column—extraction and scrub, flooding points were interpreted to occur in the extraction section.

^ePulse wave—truncated sine.

^fThe symbol % is generally volume percent, unless otherwise specified, interpreted as follows: 5% acetone in Toluene, means that Toluene was added to 50 ml pure acetone until the solution was a liter in volume.

Table A-1 (Continued)

Data Point Number	Ref.	System		Column Height (ft)	Hole Pattern	Plate	Thickness	Note
		Organic	Aqueous			Hole Space (in.)		
1133-1135	34	42% TBP - Spec. Naphtha No. 1	0.5 M $\text{Al}(\text{NO}_3)_3$	24	Triangle	-	-	b,d
1136-1139	33	42% TBP - Spec. Naphtha No. 1	0.4 M $\text{Al}(\text{NO}_3)_3$, 0.003 M H_3PO_4	24	Triangle	-	-	b,d
1140-1145	55	4.5% TBP-Amsco	1.5 M $\text{Al}(\text{NO}_3)_3$, 1 M HNO_3	24	Triangle	-	-	b
1146-1150		4.5% TBP-Amsco, 0.01 M $\text{UO}_2(\text{NO}_3)_2$	0.7 M $\text{Al}(\text{NO}_3)_3$, 0.003 M $\text{UO}_2(\text{NO}_3)_2$	24	Triangle	-	-	b
1151-1154		4.5% TBP-Amsco, 0.01 M $\text{UO}_2(\text{NO}_3)_2$	H_2O	24	Triangle	-	-	b
1155-1188	22	Iso-amyl alcohol, 0.008 g boric acid/liter	0.005 g boric acid/liter	-	53 holes	-	-	b
1189,1190		Iso-amyl alcohol, 0.003 g boric acid/liter	H_2O	-	53 holes	-	-	b
1191-1236	30,31	Methyl isobutyl ketone	H_2O	-	-	-	26 gage	f
1237-1241		Methyl isobutyl ketone	H_2O	-	-	-	26 gage	
1242-1250	86	10% TBP - Amsco 123-15	0.5 g U/liter, 0.75 M $\text{Al}(\text{NO}_3)_3$, 1 M HNO_3 , 3 M HF , 0.55 M Zr , 0.02 M Cr	14	Triangle	1/4	3/64 in.	b
1251-1258		10% TBP - Amsco 123-15	2.0 g U/liter, 3 M HNO_3 , 0.3 M SO_4 , 3 g S.S./liter	14	Triangle	1/4	3/64 in.	b
1259-1261		10% TBP - Amsco 123-15	0.7 M $\text{Al}(\text{NO}_3)_3$	8	Triangle	1/4	3/64 in.	b
1262-1265		10% TBP - Amsco + 1 g U/liter, 0.1 M HNO_3	4 g U/liter, 0.4 M HNO_3	8	Triangle	1/4	3/64 in.	b
1266-1269		10% TBP - Amsco + 0.002 M HNO_3	0.007 M HNO_3	8	Triangle	1/4	3/64 in.	b
1270-1272		10% TBP - Amsco + 0.01 M HNO_3	0.04 M HNO_3	8	Triangle	1/4	3/64 in.	b
1273-1277		10% TBP - Amsco 123-15 + 0.1 M HNO_3	0.4 M HNO_3	8	Triangle	1/4	3/64 in.	b
1278-1279		10% TBP - Amsco 123-15 + 1.5 g U/liter	6 g U/liter	8	Triangle	1/4	3/64 in.	b
1280-1282		10% TBP - Amsco 123-15 + 3 g U/liter, 0.1 M HNO_3	24 g U/liter, 0.4 M HNO_3	8	Triangle	1/4	3/64 in.	b
1283-1287	62	15% TBP - Amsco 125-90W	0.2 M $\text{Al}(\text{NO}_3)_3$, 0.04 M HNO_3	-	-	-	0.031 in.	c
1288,1289		15% TBP - Amsco	50 g U/liter, 0.25 M HNO_3	-	-	-	0.031 in.	c
1290-1292	9	30% TBP - Amsco 125-82	2.0 M HNO_3	24	Triangle	-	0.020 in.	d
1293-1299		30% TBP - Amsco	0.01 M HNO_3	24	Triangle	-	0.020 in.	
1300-1302		30% TBP - Amsco	2.0 M HNO_3	24	Triangle	-	0.020 in.	d
1303-1306		30% TBP - Amsco	0.01 M HNO_3	24	Triangle	-	0.020 in.	
1307-1319	19,20	Methyl isobutyl ketone	H_2O	3	Triangle	0.078	0.024 in.	f
1320-1329		Methyl isobutyl ketone	H_2O	3	Triangle	0.078	0.024 in.	
1330-1341	24	30% TBP - Shell E - 2342 spray base + 73 g U/liter, 0.2 M HNO_3	10 g U/liter, 2 M HNO_3	-	-	-	20-gage	
1342-1349		30% TBP - Shell E + 0.005 g U/liter, 0.02 M HNO_3	0.02 g U/liter, 0.02 M HNO_3	-	-	-	20-gage	
1350-1386		30% TBP - Shell E + 0.0016 g U/liter, 0.01 M HNO_3	0.014 g U/liter, 0.01 M HNO_3	-	-	-	20-gage	

^bIn certain data where no physical properties were reported, solutions were made up and the physical properties were measured at ORNL in 1962.

^cPulse wave—semisquare.

^dCompound column - extraction and scrub, flooding points were interpreted to occur in the extraction section.

^ePulse wave - truncated sine.

^fFlooded due to insufficient pulse.

Table A-1 (Continued)

Data Point Number	Ref.	System		Column Height (ft)	Hole Pattern	Plate		Note
		Organic	Aqueous			Hole Space (in.)	Thickness	
1387-1498	26	Heptane	H ₂ O	3	-	-	0.04 in.	
1499-1501	10	30% TBP - Amsco 125-82	2.0 M HNO ₃	24	Triangle	-	-	
1502-1516		30% TBP - Amsco 125-82	0.01 M HNO ₃	24	Triangle	-	-	
1517-1521	94	30% TBP - Amsco 125-82	3 M HNO ₃	24	Triangle	-	-	d
1522-1525		30% TBP - Amsco 125-82	0.01 M Al(NO ₃) ₃	24	Triangle	-	-	
1526-1529	95	30% TBP - Amsco 125-82 + 3 g U/liter	0.01 M HNO ₃	24	Triangle	-	-	d
1530-1572	4 20,21	Caltex kerosene	Al(NO ₃) ₃ - H ₂ O	12	Square	3/16	-	
1573-1579		Methyl isobutyl ketone	H ₂ O	1.5	Triangle	-	1/16 in.	
1580-1583		Methyl isobutyl ketone	38% ethylene glycol - H ₂ O	1.5	Triangle	-	1/16 in.	
1584-1587		Methyl isobutyl ketone	62% ethylene glycol - H ₂ O	1.5	Triangle	-	1/16 in.	
1588-1591		Methyl isobutyl ketone	82% ethylene glycol - H ₂ O	1.5	Triangle	-	1/16 in.	
1592-1595		Methyl isobutyl ketone	H ₂ O	1.5	Triangle	-	1/16 in.	
1596-1598		Toluene	H ₂ O	1.5	Triangle	-	1/16 in.	
1599-1600		Toluene - acetic acid	H ₂ O - acetic acid	1.5	Triangle	-	1/16 in.	
1601-1645	73	Trichloroethylene	H ₂ O	4	Triangle	-	20 bwg	b
1646-1651	96	5% TBP - Amsco 125-82	2 M HNO ₃	24	Triangle	-	0.020 in.	d
1652-1661		5% TBP - Amsco 125-82	0.01 M HNO ₃	12	Triangle	-	0.020 in.	
1662-1664	97	5% TBP - Amsco 125-82	2 g U/liter, 1.8 M Al(NO ₃) ₃	24	Triangle	-	0.020 in.	d
1665-1671		5% TBP - Amsco 125-82	1.8 M Al(NO ₃) ₃	24	Triangle	-	0.020 in.	
1672-1680	100	0.3 M Alamine 304 - diethylbenzene	1.5 - 2.0 M HNO ₃	24	Triangle	-	0.020 in.	d
1681-1690		0.3 M Alamine 304 - diethylbenzene + 0.5 M HNO ₃	2 M acetic acid	12	Triangle	-	0.020 in.	
1691-1694		0.3 M Alamine 304 - diethylbenzene + 0.3 M HNO ₃	1 M Na ₂ CO ₃	12	Triangle	-	0.020 in.	
1695-1700	101	30% TBP - Amsco 125-82	2 M HNO ₃	24	Triangle	-	0.020 in.	
1701-1703		30% TBP - Amsco 125-82 + 80 g U/liter	0.01 M HNO ₃	12	Triangle	-	0.020 in.	
1704-1707		30% TBP - Amsco 125-82	2 M HNO ₃	24	Triangle	-	0.020 in.	
1708-1710		30% TBP - Amsco 125-82 + 80 g U/liter	0.01 M HNO ₃	12	Triangle	-	0.020 in.	
1711-1715	102	2.5% di-sec-butylphenylphosphonate - diethylbenzene	5 g U/liter, 260 g Th/liter, 0.8 M Al(NO ₃) ₃	24	Triangle	-	0.020 in.	d
1716-1721		2.5% di-sec-butylphenylphosphonate - diethylbenzene + 2 g U/liter	0.004 M HNO ₃	24	Triangle	-	0.020 in.	
1722	19,20	This point belongs with point No. 1307-1329.						

^bIn certain data where no physical properties were reported, solutions were made up and the physical properties were measured at ORNL in 1962.

^dCompound column - extraction and scrub, flooding points were interpreted to occur in the extraction section.

Table A-2. Code for Flooding Data, Table A-3

Column	Meaning of Code Numbers
Transfer	1—Solute being transferred primarily from organic to aqueous phase.
	2—Solute being transferred primarily from aqueous to organic phase.
	3—Mass transfer in only a part of the column as in the end of a scrub tower where scrub is introduced.
	4—No mass transfer; phases are thought to be in equilibrium.
Continuous Phase	1—Aqueous phase continuous
	2—Organic phase continuous
	3—Zebra formation, alternate organic continuous and aqueous continuous sections in same column, with flooding due primarily to aqueous phase.
	4—Zebra formation with flooding due primarily to organic phase.
Cartridge	1—Stainless steel plates
	2—Brass plates
	3—Steel plates
	4—Hastelloy C plates
	5—Stainless steel nozzle plates, oriented down --
	6—Stainless steel nozzle plates, oriented up --
	31—Fluorothene (Kel-F) plates, polytrifluoromonoethylene
	32—Lucoflex plates, chlorinated polyvinyl chloride
	33—Zebra in scrub section, see notes on Points 1499-1516.
	34—Teflon plates

Table A-3. Flooding Data

Point No.	V _C	V _D (ft/hr)	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
1	46.60	60.1000	0.1250	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
2	46.60	17.4000	1.0000	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
3	46.60	92.9000	0.5000	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
4	35.00	92.9000	0.1250	200.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
5	46.60	31.1000	1.0000	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
6	46.60	41.6000	0.1250	50.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
7	46.60	83.0000	1.0000	50.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
8	70.00	49.6000	0.5000	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
9	70.00	65.1000	1.0000	50.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
10	70.00	92.9000	0.5000	50.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
11	35.00	91.5000	0.2500	200.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
12	46.60	66.2000	0.2500	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
13	46.60	77.7000	0.1250	200.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
14	46.60	46.6000	0.2500	50.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
15	70.00	70.9000	0.2500	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
16	35.00	80.9000	0.2500	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
17	70.00	25.2000	1.0000	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
18	70.00	54.0000	0.1250	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
19	35.00	26.8000	1.0000	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
20	70.00	23.3000	0.2500	50.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
21	35.00	54.9000	0.2500	50.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
22	70.00	94.7000	0.4830	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
23	70.00	51.7000	0.2500	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
24	35.00	57.0000	0.1200	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
25	35.00	101.8000	0.2500	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
26	35.00	57.0000	0.9650	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
27	46.60	82.8000	0.2500	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
28	70.00	74.6000	0.1250	200.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
29	35.00	66.0000	0.1250	100.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
30	46.60	15.6000	0.4550	165.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
31	70.00	40.6000	0.1200	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
32	70.00	44.5000	0.2500	200.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
33	70.00	103.5000	1.0000	25.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
34	70.00	103.5000	1.0000	25.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
35	70.00	97.0000	0.1250	40.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
36	70.00	44.5000	0.5000	25.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
37	70.00	80.9000	0.2500	150.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
38	46.60	62.0000	0.5000	25.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
39	46.60	98.1000	0.5000	50.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I
40	46.60	99.2000	0.2500	150.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	I	I

*See Table A-2 for meaning of code for Tr (transfer), CP (continuous phase), and Ct (cartridge).

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
41	46.60	77.2000	0.2500	200.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	1	1
42	35.00	75.6000	0.5000	25.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	1	1
43	35.00	83.0000	0.5000	150.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	1	1
44	35.00	36.9000	0.5000	200.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	1	1
45	46.60	106.5000	0.5000	75.0	15.10	3.4200	3.3100	0.7720	1.2400	0.1110	1.002	0.2300	1.938	4	1	1
46	70.00	21.4000	0.5000	26.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
47	70.00	43.5000	0.5000	50.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
48	70.00	46.5000	0.5000	72.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
49	70.00	35.3000	0.5000	98.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
50	70.00	13.5300	0.5000	154.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
51	70.00	21.6300	0.2500	50.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
52	70.00	37.3000	0.2500	100.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
53	70.00	39.5000	0.2500	150.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
54	70.00	28.0000	0.2500	200.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
55	70.00	31.1000	0.5000	28.0	10.50	2.4800	1.7200	0.8280	1.1240	0.1110	1.002	0.2300	1.938	4	1	1
56	70.00	65.6000	0.5000	50.0	10.50	2.4800	1.7200	0.8280	1.1240	0.1110	1.002	0.2300	1.938	4	1	1
57	70.00	66.8000	0.5000	76.0	10.50	2.4800	1.7200	0.8280	1.1240	0.1110	1.002	0.2300	1.938	4	1	1
58	70.00	42.6000	0.5000	98.0	10.50	2.4800	1.7200	0.8280	1.1240	0.1110	1.002	0.2300	1.938	4	1	1
59	70.00	21.8000	0.5000	150.0	10.50	2.4800	1.7200	0.8280	1.1240	0.1110	1.002	0.2300	1.938	4	1	1
60	46.60	13.6000	0.5000	70.0	14.80	1.4800	9.2000	0.7730	1.3620	0.1110	1.002	0.2300	1.938	4	1	1
61	46.60	11.9000	0.5000	70.0	15.60	1.5600	10.6300	0.7730	1.3660	0.1110	1.002	0.2300	1.938	4	1	1
62	46.60	12.0000	0.5000	70.0	14.80	1.4600	9.4700	0.7730	1.3620	0.1110	1.002	0.2300	1.938	4	1	1
63	46.60	17.8000	0.5000	70.0	15.30	1.3700	7.2700	0.7730	1.3470	0.1110	1.002	0.2300	1.938	4	1	1
64	46.60	32.0000	0.5000	70.0	15.40	1.1800	4.6200	0.7730	1.3230	0.1110	1.002	0.2300	1.938	4	1	1
65	46.60	24.8000	0.5000	70.0	14.40	1.2100	4.9900	0.7730	1.2990	0.1110	1.002	0.2300	1.938	4	1	1
66	46.60	33.6000	0.5000	70.0	15.00	1.2300	4.0200	0.7730	1.2770	0.1110	1.002	0.2300	1.938	4	1	1
67	46.60	36.0000	0.5000	70.0	15.50	1.1400	3.5100	0.7730	1.2640	0.1110	1.002	0.2300	1.938	4	1	1
68	46.60	43.4000	0.5000	70.0	15.10	1.1500	3.1200	0.7730	1.2480	0.1110	1.002	0.2300	1.938	4	1	1
69	46.60	52.7000	0.5000	70.0	15.70	1.3900	3.1100	0.7730	1.2340	0.1110	1.002	0.2300	1.938	4	1	1
70	46.60	53.8000	0.5000	70.0	14.70	1.3700	2.8800	0.7730	1.2210	0.1110	1.002	0.2300	1.938	4	1	1
71	46.60	54.5000	0.5000	70.0	15.10	1.2800	2.7600	0.7730	1.2210	0.1110	1.002	0.2300	1.938	4	1	1
72	46.60	58.0000	0.5000	70.0	14.90	1.3100	2.5600	0.7730	1.2110	0.1110	1.002	0.2300	1.938	4	1	1
73	46.60	61.9000	0.5000	70.0	15.80	1.2500	2.3700	0.7730	1.2020	0.1110	1.002	0.2300	1.938	4	1	1
74	46.60	66.1000	0.5000	70.0	14.80	1.2500	2.2100	0.7730	1.1730	0.1110	1.002	0.2300	1.938	4	1	1
75	46.60	58.7000	0.5000	70.0	14.60	1.4800	2.6000	0.7730	1.1750	0.1110	1.002	0.2300	1.938	4	1	1
76	46.60	63.1000	0.5000	70.0	14.50	1.3200	2.2600	0.7730	1.1540	0.1110	1.002	0.2300	1.938	4	1	1
77	46.60	64.5000	0.5000	70.0	14.90	1.1900	2.1000	0.7730	1.1410	0.1110	1.002	0.2300	1.938	4	1	1
78	46.60	65.0000	0.5000	70.0	14.90	1.1000	1.8600	0.7730	1.1280	0.1110	1.002	0.2300	1.938	4	1	1
79	46.60	19.6000	0.5000	70.0	8.90	3.2200	7.6300	0.8280	1.3530	0.1110	1.002	0.2300	1.938	4	1	1
80	46.60	27.9000	0.5000	70.0	10.80	3.6000	7.0800	0.8280	1.3380	0.1110	1.002	0.2300	1.938	4	1	1

Table A-3 (continued)

Point No.	V _C	V _D (ft/hr)	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
81	46.60	31.0000	0.5000	70.0	10.50	3.5100	6.4900	0.8280	1.3260	0.1110	1.002	0.2300	1.938	4	1	1
82	46.60	41.3000	0.5000	70.0	10.50	3.6100	5.3600	0.8280	1.3070	0.1110	1.002	0.2300	1.938	4	1	1
83	46.60	47.5000	0.5000	70.0	10.90	3.1800	4.1200	0.8280	1.2970	0.1110	1.002	0.2300	1.938	4	1	1
84	46.60	54.7000	0.5000	70.0	12.20	3.5200	4.3500	0.8280	1.2760	0.1110	1.002	0.2300	1.938	4	1	1
85	46.60	64.0000	0.5000	70.0	11.00	3.5600	3.7100	0.8280	1.2700	0.1110	1.002	0.2300	1.938	4	1	1
86	46.60	71.2000	0.5000	70.0	10.90	3.7800	3.4500	0.8280	1.2570	0.1110	1.002	0.2300	1.938	4	1	1
87	46.60	61.9000	0.5000	70.0	10.70	3.5800	3.8000	0.8280	1.2720	0.1110	1.002	0.2300	1.938	4	1	1
88	46.60	69.2000	0.5000	70.0	10.60	3.8200	3.4000	0.8280	1.2460	0.1110	1.002	0.2300	1.938	4	1	1
89	46.60	72.3000	0.5000	70.0	10.90	3.3200	3.1500	0.8280	1.2390	0.1110	1.002	0.2300	1.938	4	1	1
90	46.60	73.3000	0.5000	70.0	12.40	3.1900	2.7500	0.8280	1.2160	0.1110	1.002	0.2300	1.938	4	1	1
91	46.60	80.6000	0.5000	70.0	10.80	3.1900	2.4900	0.8280	1.1890	0.1110	1.002	0.2300	1.938	4	1	1
92	46.60	80.6000	0.5000	70.0	10.70	3.1600	2.3500	0.8280	1.1750	0.1110	1.002	0.2300	1.938	4	1	1
93	46.60	67.1000	0.5000	70.0	11.60	2.2600	2.4200	0.8280	1.1970	0.1110	1.002	0.2300	1.938	4	1	1
94	46.60	74.4000	0.5000	70.0	10.60	2.4800	2.1400	0.8280	1.1570	0.1110	1.002	0.2300	1.938	4	1	1
95	46.60	73.3000	0.5000	70.0	11.00	2.4000	2.0600	0.8280	1.1430	0.1110	1.002	0.2300	1.938	4	1	1
96	46.60	73.3000	0.5000	70.0	11.00	2.2200	1.9400	0.8280	1.1300	0.1110	1.002	0.2300	1.938	4	1	1
97	46.60	13.4000	0.5000	70.0	9.66	2.2100	7.9100	0.8770	1.3620	0.1110	1.002	0.2300	1.938	4	1	1
98	46.60	17.6000	0.5000	70.0	9.60	2.0200	5.6700	0.8770	1.3230	0.1110	1.002	0.2300	1.938	4	1	1
99	46.60	24.8000	0.5000	70.0	9.82	2.5400	4.8800	0.8770	1.3020	0.1110	1.002	0.2300	1.938	4	1	1
100	46.60	42.3000	0.5000	70.0	9.30	3.5300	4.0200	0.8770	1.2830	0.1110	1.002	0.2300	1.938	4	1	1
101	46.60	46.6000	0.5000	70.0	8.90	3.5600	4.5000	0.8770	1.2850	0.1110	1.002	0.2300	1.938	4	1	1
102	46.60	57.8000	0.5000	70.0	9.48	4.4600	3.8200	0.8770	1.2760	0.1110	1.002	0.2300	1.938	4	1	1
103	46.60	72.3000	0.5000	70.0	9.54	4.7500	3.3800	0.8770	1.2610	0.1110	1.002	0.2300	1.938	4	1	1
104	46.60	85.7000	0.5000	70.0	9.63	5.6900	2.9800	0.8770	1.2310	0.1110	1.002	0.2300	1.938	4	1	1
105	46.60	72.3000	0.5000	70.0	8.89	4.9200	2.9500	0.8770	1.2240	0.1110	1.002	0.2300	1.938	4	1	1
106	46.60	82.6000	0.5000	70.0	9.75	5.1300	2.9500	0.8770	1.2260	0.1110	1.002	0.2300	1.938	4	1	1
107	31.10	59.0000	0.5000	70.0	8.90	3.5600	4.5000	0.8770	1.2850	0.1110	1.002	0.2300	1.938	4	1	1
108	38.80	52.5000	0.5000	70.0	8.90	3.5600	4.5000	0.8770	1.2850	0.1110	1.002	0.2300	1.938	4	1	1
109	46.60	46.6000	0.5000	70.0	8.90	3.5600	4.5000	0.8770	1.2850	0.1110	1.002	0.2300	1.938	4	1	1
110	58.30	38.0000	0.5000	70.0	8.90	3.5600	4.5000	0.8770	1.2850	0.1110	1.002	0.2300	1.938	4	1	1
111	70.00	28.8000	0.5000	70.0	8.90	3.5600	4.5000	0.8770	1.2850	0.1110	1.002	0.2300	1.938	4	1	1
112	83.00	94.2000	0.3500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
113	105.00	83.3000	0.3500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
114	126.80	74.4000	0.3500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
115	149.50	66.5000	0.3500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
116	176.40	63.9000	0.3500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
117	62.00	83.5000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
118	84.50	72.8000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
119	106.00	68.9000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
120	129.50	52.9000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
121	154.10	43.0000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
122	176.40	39.7000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
123	21.80	67.0000	0.7200	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
124	40.80	59.7000	0.7200	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
125	84.00	44.8000	0.7200	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
126	106.00	35.8000	0.7200	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
127	124.20	50.2000	0.7200	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
128	84.60	115.8000	0.2500	210.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
129	95.80	98.4000	0.2500	210.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
130	106.80	104.8000	0.2500	210.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
131	118.30	89.6000	0.2500	210.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
132	130.70	87.9000	0.2500	210.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
133	152.90	79.3000	0.2500	210.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
134	176.30	74.7000	0.2500	210.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
135	41.80	68.4000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
136	63.20	52.3000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
137	56.10	61.1000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
138	55.10	62.4000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
139	48.70	84.1000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
140	42.40	105.7000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
141	38.50	131.7000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
142	26.40	154.2000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
143	22.00	61.3000	0.3750	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
144	41.80	51.3000	0.3750	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
145	61.00	42.1000	0.3750	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
146	85.40	31.9000	0.3750	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
147	106.70	24.3000	0.3750	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
148	21.70	45.7000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
149	21.90	42.3000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
150	42.00	37.1000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
151	61.10	29.1000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
152	84.60	24.4000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
153	107.00	16.6000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
154	41.70	74.3000	0.5000	90.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
155	60.60	61.4000	0.5000	90.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
156	84.00	52.6000	0.5000	90.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
157	106.20	45.3000	0.5000	90.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
158	131.50	39.0000	0.5000	90.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
159	41.80	67.5000	0.5000	120.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
160	60.80	50.4000	0.5000	120.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C	V _D	A	F	Y	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Cr*
	(ft/hr)		(in.)	(cycles min)	(dynes cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
161	62.20	51.6000	0.5000	120.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
162	75.20	44.0000	0.5000	120.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
163	84.70	45.3000	0.5000	120.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
164	95.10	36.4000	0.5000	120.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
165	106.50	28.7000	0.5000	120.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
166	131.70	22.1000	0.5000	120.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
167	22.10	55.2000	0.5000	150.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
168	42.20	41.6000	0.5000	150.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
169	62.30	31.6000	0.5000	150.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
170	84.30	25.4000	0.5000	150.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
171	107.00	20.4000	0.5000	150.0	36.00	0.9260	1.0600	0.7720	0.9980	0.0625	2.875	0.2460	2.000	4	1	2
172	92.20	70.7000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
173	117.50	56.8000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
174	144.10	46.6000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
175	169.70	28.5000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
176	196.90	20.8000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
177	106.00	62.5000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.000	4	1	2
178	107.00	61.6000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.000	4	1	2
179	130.00	55.1000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.000	4	1	2
180	153.00	52.8000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.000	4	1	2
181	153.00	47.2000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.000	4	1	2
182	50.80	53.1000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.500	4	1	2
183	105.40	40.0000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.500	4	1	2
184	128.50	33.1000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.500	4	1	2
185	152.00	28.4000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.500	4	1	2
186	176.30	23.3000	0.5000	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	1.500	4	1	2
187	103.50	98.3000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
188	127.00	86.4000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
189	149.90	80.7000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
190	173.90	75.2000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
191	199.90	68.3000	0.2500	180.0	36.00	0.9260	1.0600	0.7720	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
192	22.60	106.4000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
193	43.70	90.0000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
194	64.20	80.0000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
195	76.60	67.3000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
196	87.20	63.5000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
197	105.50	45.8000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
198	105.60	48.1000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
199	127.00	35.9000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
200	57.30	101.0000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	H _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
201	79.10	88.3000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
202	93.60	66.6000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
203	97.00	62.2000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
204	127.40	55.2000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
205	148.30	40.4000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
206	22.90	68.4000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
207	44.20	54.1000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
208	85.00	44.5000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
209	129.00	27.7000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
210	148.20	23.4000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
211	22.40	58.6000	0.5200	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
212	43.40	51.4000	0.5200	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
213	63.60	39.4000	0.5200	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
214	84.20	27.3000	0.5200	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
215	105.60	23.0000	0.5200	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
216	7.90	44.4000	0.8700	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
217	22.50	23.0000	0.8700	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
218	32.40	14.8000	0.8700	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
219	43.40	10.9000	0.8700	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
220	53.00	4.1000	0.8700	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
221	23.00	76.0000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
222	42.80	59.2000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
223	43.80	77.7000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
224	63.80	55.6000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
225	85.00	49.5000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
226	106.30	39.3000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
227	126.70	31.5000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
228	22.50	60.3000	0.2400	300.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
229	32.90	52.2000	0.2400	300.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
230	43.80	49.3000	0.2400	300.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
231	84.90	33.9000	0.2400	300.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
232	128.30	20.9000	0.2400	300.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
234	22.50	51.8000	0.2400	360.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
235	43.70	41.3000	0.2400	360.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
236	64.00	28.8000	0.2400	360.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
237	85.10	22.8000	0.2400	360.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
238	128.30	13.2000	0.2400	360.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
239	22.80	46.7000	0.2400	420.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
240	32.20	37.2000	0.2400	420.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
241	43.10	35.0000	0.2400	420.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
		(ft/hr)	(in.)	($\frac{\text{cycles}}{\text{min}}$)	($\frac{\text{dynes}}{\text{cm}}$)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
242	62.70	16.7000	0.2400	420.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
243	85.50	12.1000	0.2400	420.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
244	22.90	86.1000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
245	30.90	71.3000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
246	31.30	188.0000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
247	43.90	58.4000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
248	45.10	151.5000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
249	55.80	56.7000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
250	66.80	66.4000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
251	67.00	50.1000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
252	76.20	53.9000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
253	78.30	42.6000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
254	91.80	38.0000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
255	92.40	38.4000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
256	119.40	28.2000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
257	121.50	28.7000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
258	149.60	24.5000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
259	152.30	25.0000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
260	181.00	15.3000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
261	184.10	15.6000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	0.500	4	1	2
262	81.60	123.5000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
263	82.40	135.7000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
264	104.40	106.5000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
265	128.00	97.4000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
266	151.50	77.1000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
267	176.70	71.1000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
268	191.10	65.1000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
269	43.40	89.4000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
270	85.10	71.7000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
271	125.20	52.3000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
272	167.20	46.4000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
273	63.60	73.9000	0.2400	120.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
274	73.40	78.7000	0.2400	120.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
275	87.30	56.0000	0.2400	120.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
276	104.40	47.0000	0.2400	120.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
277	125.40	41.3000	0.2400	120.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
278	146.50	30.8000	0.2400	120.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
279	62.80	81.4000	0.2400	150.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
280	84.80	52.3000	0.2400	150.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
281	95.90	54.8000	0.2400	150.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Cr*
282	114.70	39.5000	0.2400	150.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
283	127.00	25.2000	0.2400	150.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1310	2.000	4	1	2
284	43.30	92.4000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
285	65.10	84.4000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
286	80.90	71.1000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
287	84.50	85.1000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
288	86.40	74.2000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
289	105.30	59.3000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
290	108.50	62.1000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
291	127.00	52.1000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
292	130.20	50.1000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
293	149.70	40.1000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
294	163.50	36.5000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
295	22.80	50.3000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
296	22.90	84.1000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
297	43.30	39.0000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
298	43.50	64.9000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
299	62.50	32.9000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
300	65.10	33.9000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
301	84.30	22.0000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
302	105.40	13.3000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
303	108.30	7.7000	0.3900	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
304	43.30	60.2000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
305	43.80	71.8000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
306	62.50	53.5000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
307	62.50	63.4000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
308	65.50	50.1000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
309	74.60	45.5000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
310	84.80	40.7000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
311	86.00	38.6000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
312	103.90	30.9000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
313	106.10	23.9000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
314	107.90	25.4000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
315	116.70	18.3000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
316	126.60	15.1000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
317	126.70	9.9000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
318	126.70	9.5000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
319	130.00	16.0000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.1720	2.000	4	1	2
320	63.90	85.8000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
321	84.80	75.3000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C	V _D (ft/hr)	A (in.)	F (cycles/min)	Y (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
322	104.50	64.1000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
323	125.10	58.3000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
324	165.80	38.9000	0.2400	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
325	82.50	126.7000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
326	91.90	106.7000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
327	127.60	92.5000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
328	160.20	78.5000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
329	177.80	69.9000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
330	60.90	130.2000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
331	74.50	146.1000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
332	82.80	74.5000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
333	91.60	106.5000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
334	103.70	54.8000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
335	104.70	79.7000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
336	119.10	62.2000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
337	128.30	42.8000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
338	136.80	44.1000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
339	150.80	32.3000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
340	151.70	34.2000	0.7500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
341	63.60	80.0000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
342	84.80	66.3000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
343	104.50	83.1000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
344	104.50	56.9000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
345	127.80	47.2000	0.2400	240.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.3900	2.000	4	1	2
346	82.40	118.0000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.6210	2.000	4	1	2
347	102.80	98.7000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.6210	2.000	4	1	2
348	127.00	82.6000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.6210	2.000	4	1	2
349	160.00	63.0000	0.2500	180.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.6210	2.000	4	1	2
350	127.10	47.5000	0.5000	210.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.6210	2.000	4	1	2
360	127.80	50.8000	0.5000	210.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.6210	2.000	4	1	2
361	137.60	38.2000	0.5000	210.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.6210	2.000	4	1	2
362	149.00	32.0000	0.5000	210.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.6210	2.000	4	1	2
363	177.30	29.1000	0.5000	210.0	34.00	0.5850	1.0600	0.8640	0.9980	0.1250	2.875	0.6210	2.000	4	1	2
364	60.80	104.1000	0.2500	180.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
365	84.30	86.7000	0.2500	180.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
366	106.20	72.2000	0.2500	180.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
367	129.10	58.8000	0.2500	180.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
368	155.90	48.7000	0.2500	180.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
369	21.90	97.6000	0.5000	180.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
370	41.40	59.0000	0.5000	180.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ_D	μ_C	ρ_D	ρ_C	d	D	ϵ	S	Tr*	CP*	Ct*
	(ft/hr)		(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
371	61.20	33.5000	0.5000	180.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
372	82.70	20.5000	0.5000	180.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
373	61.00	131.0000	0.2500	120.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
374	82.70	117.1000	0.2500	120.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
375	106.40	99.7000	0.2500	120.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
376	129.50	84.9000	0.2500	120.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
377	154.10	77.1000	0.2500	120.0	14.20	0.7480	0.9970	0.8810	0.9970	0.1250	2.875	0.2460	2.000	4	1	2
378	83.90	145.1000	0.2500	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
379	104.60	124.1000	0.2500	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
380	128.50	109.6000	0.2500	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
381	178.60	76.6000	0.2500	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
382	82.00	124.2000	0.3700	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
383	104.00	112.5000	0.3700	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
384	129.20	86.4000	0.3700	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
385	153.30	70.4000	0.3700	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
386	177.50	57.6000	0.3700	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
387	41.30	141.5000	0.5000	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
388	61.40	113.2000	0.5000	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
389	83.10	90.5000	0.5000	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
390	106.60	71.7000	0.5000	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
391	129.80	49.7000	0.5000	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
392	130.10	54.7000	0.5000	180.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
393	82.60	146.4000	0.2500	210.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
394	103.30	117.6000	0.2500	210.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
395	128.50	97.2000	0.2500	210.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
396	152.90	83.1000	0.2500	210.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
397	178.00	67.1000	0.2500	210.0	10.10	0.6140	1.0600	0.8050	0.9960	0.1250	2.875	0.2460	2.000	4	1	2
398	97.40	137.5000	0.2500	180.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
399	105.80	130.4000	0.2500	180.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
400	128.60	119.3000	0.2500	180.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
401	151.60	108.3000	0.2500	180.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
402	175.80	105.2000	0.2500	180.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
403	95.50	126.0000	0.2500	210.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
404	119.60	101.5000	0.2500	210.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
405	129.80	99.6000	0.2500	210.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
406	153.70	89.2000	0.2500	210.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
407	177.50	84.9000	0.2500	210.0	40.00	0.4860	1.0600	0.6910	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
408	40.00	136.2000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
409	61.40	112.5000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
410	82.60	77.8000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F ($\frac{\text{cycles}}{\text{min}}$)	γ ($\frac{\text{dynes}}{\text{cm}}$)	μ_D (centipoises)	μ_C	ρ_D (gm/cm ³)	ρ_C	d (in.)	D (in.)	ϵ	S (in.)	Tr*	CP*	Ct*
411	104.50	62.8000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
412	125.90	46.2000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
413	151.20	28.3000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
414	20.30	60.5000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
415	32.50	53.6000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
416	39.80	44.1000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
417	47.30	33.1000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
418	60.40	29.1000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	2.000	4	1	2
419	39.10	107.0000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
420	59.60	83.1000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
421	80.10	86.5000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
422	127.40	50.9000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
423	149.10	46.2000	0.2500	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
424	24.30	105.0000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
425	38.50	83.3000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
426	38.80	74.8000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
427	59.90	65.5000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
428	81.20	54.2000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
429	124.00	53.9000	0.5000	180.0	8.50	0.4900	1.0600	0.9050	0.9980	0.1250	2.875	0.2460	3.000	4	1	2
561	76.50	74.4000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
562	50.80	85.4000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
563	91.60	69.7000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
564	111.00	64.3000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
565	127.00	59.2000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
566	144.10	54.3000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
567	42.40	90.5000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
568	169.80	45.4000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
569	215.50	25.2000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
570	75.20	76.8000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
571	107.90	62.1000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
572	136.50	48.7000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
573	179.00	36.1000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
574	215.50	18.5000	0.2500	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
575	107.90	62.1000	0.3100	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
576	126.00	56.6000	0.3100	180.0	34.00	0.5850	1.0020	0.5850	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
577	136.50	52.5000	0.3100	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
578	179.00	43.5000	0.3100	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
579	215.50	34.4000	0.3100	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
580	75.20	71.5000	0.2500	120.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
581	108.00	63.0000	0.2500	120.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
		(ft/hr)	(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
582	137.00	42.5000	0.2500	120.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
583	179.00	25.4000	0.2500	120.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
584	215.50	14.3000	0.2500	120.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
585	51.20	77.7000	0.2500	120.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
586	59.00	71.5000	0.2500	120.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
587	44.00	94.0000	0.2500	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
588	66.50	74.2000	0.2500	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
589	79.50	74.5000	0.2500	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
590	114.00	61.5000	0.2500	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
591	144.00	48.0000	0.2500	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
592	150.00	46.0000	0.2500	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
593	168.00	39.5000	0.2500	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
594	226.00	27.5000	0.2500	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
595	75.20	73.5000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
596	108.00	56.7000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
597	166.00	45.8000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
598	219.00	27.3000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
599	75.20	69.3000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
600	108.00	56.6000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
601	46.50	137.0000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
602	39.90	179.0000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
603	215.00	25.4000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
604	51.30	83.0000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
605	247.00	16.0000	0.2500	210.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	6.250	0.2500	2.000	4	1	1
606	60.90	92.9000	0.2200	180.0	36.30	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
607	90.00	87.1000	0.2200	180.0	36.30	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
608	105.00	82.7000	0.2200	180.0	36.30	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
609	75.50	90.0000	0.2200	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
610	47.90	97.2000	0.2200	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
611	31.90	119.0000	0.2200	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
612	120.00	56.8000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
613	103.00	61.5000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
614	88.50	69.6000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
615	73.90	78.3000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
616	60.90	85.8000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
617	46.40	89.9000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
618	32.50	95.7000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
619	16.80	102.9000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
620	52.80	85.3000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
621	110.20	63.2000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D (ft/hr)	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C (centipoises)	ρ _D (gm/cm ³)	ρ _C (gm/cm ³)	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	C†*
622	96.30	65.2000	0.4840	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
623	103.00	60.4000	0.5220	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
624	90.00	62.1000	0.5220	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
625	75.50	68.5000	0.5220	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
626	59.50	76.0000	0.5220	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
627	46.40	80.7000	0.5220	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
628	103.00	58.6000	0.5600	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
629	90.00	60.9000	0.5600	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
630	74.30	66.8000	0.5600	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
631	60.90	72.5000	0.5600	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
632	46.40	76.0000	0.5600	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
633	31.90	91.0000	0.5600	180.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
634	90.00	87.5000	0.6500	120.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
635	103.00	78.5000	0.6500	120.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
636	119.00	69.7000	0.6500	120.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
637	128.00	65.0000	0.6500	120.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
638	75.50	91.5000	0.6500	120.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
639	78.50	84.2000	0.6500	120.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
640	95.80	83.0000	0.6500	120.0	34.00	0.9260	1.0020	0.7720	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
641	116.00	54.7000	0.2400	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
642	102.00	62.3000	0.2400	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
643	87.30	65.8000	0.2400	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
644	87.30	72.7000	0.2400	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
645	74.20	73.3000	0.2400	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
646	59.60	77.4000	0.2400	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
647	45.10	82.1000	0.2400	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
648	33.50	86.3000	0.2400	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
649	102.00	50.0000	0.2550	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
650	87.30	54.6000	0.2550	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
651	87.30	55.0000	0.2550	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
652	74.20	62.2000	0.2550	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
653	59.70	64.6000	0.2550	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
654	46.60	71.0000	0.2550	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
655	33.50	79.5000	0.2550	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
656	87.30	37.2000	0.3700	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
657	74.20	42.5000	0.3700	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
658	59.70	47.7000	0.3700	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
659	46.60	54.7000	0.3700	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
660	33.50	59.1000	0.3700	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
661	21.80	63.1000	0.3700	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2

Table A-3 (continued)

Point No.	V _C	V _D	A	F	Y	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
	(ft/hr)		(in.)	($\frac{\text{cycles}}{\text{min}}$)	($\frac{\text{dynes}}{\text{cm}}$)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
662	87.30	29.4000	0.4800	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
663	74.20	32.0000	0.4800	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
664	59.70	34.6000	0.4800	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
665	46.60	37.5000	0.4800	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
666	33.50	39.6000	0.4800	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
667	21.80	50.1000	0.4800	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
668	102.00	20.7000	0.5200	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
669	87.30	25.1000	0.5200	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
670	74.20	28.8000	0.5200	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
671	59.70	32.0000	0.5200	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
672	46.60	37.3000	0.5200	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
673	46.60	23.3000	0.6100	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
674	33.50	28.8000	0.6100	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
675	21.80	36.7000	0.6100	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
676	16.60	43.1000	0.6100	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
677	14.00	46.0000	0.6100	180.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
678	114.00	58.3000	0.2400	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
679	94.60	64.0000	0.2400	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
680	107.00	65.2000	0.2400	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
681	87.30	66.3000	0.2400	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
682	74.20	72.7000	0.2400	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
683	53.80	80.9000	0.2400	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
684	59.70	83.8000	0.2400	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
685	47.40	84.4000	0.2400	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
686	48.00	88.2000	0.2400	150.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
687	116.40	44.8000	0.2400	240.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
688	102.00	46.3000	0.2400	240.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
689	87.30	47.4000	0.2400	240.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
690	74.20	55.0000	0.2400	240.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
691	59.70	58.8000	0.2400	240.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
692	33.50	72.5000	0.2400	240.0	34.00	0.5850	1.0020	0.8640	0.9980	0.1250	12.000	0.2500	2.000	4	1	2
693	45.50	44.6000	0.2500	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
694	45.50	44.6000	0.2500	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
695	101.90	9.3000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
696	87.90	17.3000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
697	75.40	21.5000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
698	67.00	24.4000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
699	59.20	29.0000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
700	52.80	32.5000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
701	34.80	35.4000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F ($\frac{\text{cycles}}{\text{min}}$)	γ ($\frac{\text{dynes}}{\text{cm}}$)	μ_D (centipoises)	μ_C	ρ_D (gm/cm ³)	ρ_C	d (in.)	D (in.)	ϵ	S (in.)	Tr*	CP*	Ct*
702	34.80	35.4000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
703	34.80	35.4000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
704	36.00	47.9000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
705	40.00	37.7000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
706	34.80	44.6000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
707	29.30	47.0000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
708	23.50	52.2000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
709	13.90	59.2000	0.3700	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
710	29.30	29.0000	0.4400	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
711	29.30	29.0000	0.4500	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
712	29.30	29.0000	0.4500	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
713	23.50	24.1000	0.5100	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
714	23.50	24.1000	0.5100	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
715	23.20	24.1000	0.5100	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
716	14.20	16.5000	0.5100	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
717	14.20	16.8000	0.5100	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
718	23.50	24.1000	0.5100	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
719	23.20	24.1000	0.5100	180.0	26.10	0.6100	1.5500	0.8646	0.9915	0.1250	12.000	0.2500	2.000	1	1	2
720	35.60	14.5000	0.2400	24.8	34.60	0.5870	0.8659	0.8720	0.9966	0.1250	1.920	0.2100	2.000	4	1	1
721	37.30	15.1000	0.2400	25.0	34.70	0.5990	0.8737	0.8734	0.9967	0.1250	1.920	0.2100	2.000	4	1	1
722	111.50	44.5000	1.6500	24.5	34.60	0.5830	0.8528	0.8714	0.9964	0.1250	1.920	0.2100	2.000	4	1	1
723	112.50	45.1000	1.6500	24.8	34.80	0.6130	0.9143	0.8750	0.9973	0.1250	1.920	0.2100	2.000	4	1	1
724	85.30	34.1000	0.2400	75.3	34.80	0.6110	0.9143	0.8749	0.9973	0.1250	1.920	0.2100	2.000	4	1	1
725	83.00	33.6000	0.2400	75.4	34.90	0.6360	0.9601	0.8778	0.9978	0.1250	1.920	0.2100	2.000	4	1	1
726	19.90	8.0000	1.6500	75.2	34.80	0.6130	0.9165	0.8750	0.9973	0.1250	1.920	0.2100	2.000	4	1	1
727	19.70	8.0000	1.6500	76.3	34.70	0.6070	0.8958	0.8744	0.9970	0.1250	1.920	0.2100	2.000	4	1	1
728	13.10	31.9000	0.2400	24.5	34.80	0.6090	0.9083	0.8745	0.9972	0.1250	1.920	0.2100	2.000	4	1	1
729	12.20	30.6000	0.2400	25.1	34.90	0.6320	0.9694	0.8773	0.9978	0.1250	1.920	0.2100	2.000	4	1	1
730	28.00	69.1000	1.6500	24.8	34.60	0.5870	0.8602	0.8720	0.9965	0.1250	1.920	0.2100	2.000	4	1	1
731	27.60	68.6000	1.6500	24.7	34.50	0.5760	0.8360	0.8706	0.9962	0.1250	1.920	0.2100	2.000	4	1	1
732	24.80	62.0000	0.2400	75.2	34.80	0.5940	0.8757	0.8728	0.9968	0.1250	1.920	0.2100	2.000	4	1	1
733	24.40	61.2000	0.2400	75.4	34.50	0.5730	0.8288	0.8702	0.9961	0.1250	1.920	0.2100	2.000	4	1	1
734	7.20	18.9000	1.6500	74.3	34.80	0.6170	0.9143	0.8754	0.9973	0.1250	1.920	0.2100	2.000	4	1	1
735	5.90	14.2000	1.6500	75.2	34.80	0.5710	0.8180	0.8699	0.9959	0.1250	1.920	0.2100	2.000	4	1	1
736	63.60	63.4000	0.6300	50.7	34.80	0.5930	0.8737	0.8727	0.9967	0.1250	1.920	0.2100	2.000	4	1	1
737	63.60	63.4000	0.6300	50.2	34.80	0.6160	0.9208	0.8754	0.9973	0.1250	1.920	0.2100	2.000	4	1	1
738	45.10	45.0000	0.2800	50.0	34.80	0.6120	0.9165	0.8749	0.9973	0.1250	1.920	0.2100	2.000	4	1	1
739	47.10	47.0000	0.2800	50.2	34.80	0.5980	0.8797	0.8734	0.9968	0.1250	1.920	0.2100	2.000	4	1	1
740	32.10	32.2000	1.4400	50.0	34.80	0.6130	0.9143	0.8750	0.9973	0.1250	1.920	0.2100	2.000	4	1	1
741	33.60	33.5000	1.4400	50.0	34.80	0.5810	0.8434	0.8712	0.9963	0.1250	1.920	0.2100	2.000	4	1	1

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
		(ft/hr)	(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
742	56.10	55.7000	0.6300	28.1	34.90	0.6090	0.9125	0.8747	0.9972	0.1250	1.920	0.2100	2.000	4	1	1
743	56.10	56.5000	0.6300	28.5	34.80	0.5840	0.8527	0.8715	0.9964	0.1250	1.920	0.2100	2.000	4	1	1
744	50.10	50.3000	0.6300	71.6	34.90	0.6180	0.9337	0.8755	0.9975	0.1250	1.920	0.2100	2.000	4	1	1
745	56.80	56.4000	0.6300	72.0	34.50	0.5750	0.8306	0.8706	0.9961	0.1250	1.920	0.2100	2.000	4	1	1
746	110.70	50.4000	0.6300	50.5	34.80	0.6120	0.9125	0.8749	0.9972	0.1250	1.920	0.2100	2.000	4	1	1
747	114.20	51.9000	0.6300	50.0	34.70	0.6010	0.8917	0.8737	0.9970	0.1250	1.920	0.2100	2.000	4	1	1
748	34.70	75.2000	0.6300	50.0	34.50	0.5680	0.8112	0.8694	0.9958	0.1250	1.920	0.2100	2.000	4	1	1
749	34.60	74.6000	0.6300	50.8	34.50	0.5740	0.8325	0.8705	0.9961	0.1250	1.920	0.2100	2.000	4	1	1
750	16.20	15.9000	0.2000	20.0	34.80	0.6090	0.9143	0.8745	0.9973	0.1250	1.920	0.2100	2.000	4	1	1
751	17.10	17.1000	0.2000	20.6	34.60	0.5810	0.8471	0.8712	0.9964	0.1250	1.920	0.2100	2.000	4	1	1
752	46.20	46.8000	0.2000	80.0	34.70	0.6030	0.9000	0.8739	0.9971	0.1250	1.920	0.2100	2.000	4	1	1
753	46.30	46.4000	0.2000	80.0	34.80	0.6130	0.9143	0.8750	0.9973	0.1250	1.920	0.2100	2.000	4	1	1
754	62.50	20.9000	0.2000	49.5	34.50	0.5750	0.8379	0.8706	0.9962	0.1250	1.920	0.2100	2.000	4	1	1
755	60.00	20.5000	0.2000	50.0	34.60	0.5860	0.8528	0.8719	0.9964	0.1250	1.920	0.2100	2.000	4	1	1
756	16.10	48.6000	0.2000	50.0	34.80	0.6180	0.9292	0.8756	0.9974	0.1250	1.920	0.2100	2.000	4	1	1
757	16.30	49.0000	0.2000	50.0	34.50	0.5680	0.8148	0.8694	0.9958	0.1250	1.920	0.2100	2.000	4	1	1
758	64.30	63.7000	1.9800	20.0	34.60	0.5910	0.8697	0.8725	0.9967	0.1250	1.920	0.2100	2.000	4	1	1
759	56.90	57.0000	1.9800	19.9	34.80	0.6090	0.9062	0.8746	0.9972	0.1250	1.920	0.2100	2.000	4	1	1
760	8.20	8.1000	1.9800	79.9	34.40	0.5790	0.7908	0.8709	0.9955	0.1250	1.920	0.2100	2.000	4	1	1
761	8.40	8.1000	1.9800	80.3	34.60	0.5870	0.8398	0.8720	0.9962	0.1250	1.920	0.2100	2.000	4	1	1
762	39.40	13.5000	1.9800	50.2	34.50	0.5740	0.8324	0.8705	0.9961	0.1250	1.920	0.2100	2.000	4	1	1
763	32.70	11.0000	1.9800	49.9	34.10	0.6260	0.9512	0.8766	0.9977	0.1250	1.920	0.2100	2.000	4	1	1
764	8.20	24.6000	1.9800	50.0	34.70	0.6000	0.8856	0.8735	0.9969	0.1250	1.920	0.2100	2.000	4	1	1
765	6.50	18.7000	1.9800	50.0	34.60	0.5840	0.8509	0.8716	0.9964	0.1250	1.920	0.2100	2.000	4	1	1
766	85.60	28.6000	0.6300	20.0	34.70	0.5940	0.8877	0.8728	0.9969	0.1250	1.920	0.2100	2.000	4	1	1
767	85.10	28.9000	0.6300	20.0	34.70	0.5940	0.8737	0.8729	0.9967	0.1250	1.920	0.2100	2.000	4	1	1
768	22.60	67.3000	0.6300	19.9	34.70	0.6060	0.9021	0.8742	0.9971	0.1250	1.920	0.2100	2.000	4	1	1
769	20.40	60.6000	0.6300	20.3	34.70	0.5990	0.8877	0.8734	0.9969	0.1250	1.920	0.2100	2.000	4	1	1
770	127.30	43.0000	0.6300	80.0	34.60	0.5800	0.8490	0.8711	0.9964	0.1250	1.920	0.2100	2.000	4	1	1
771	100.10	33.7000	0.6300	80.0	34.70	0.5950	0.8856	0.8732	0.9969	0.1250	1.920	0.2100	2.000	4	1	1
772	20.40	60.9000	0.6300	80.0	34.80	0.6090	0.9083	0.8746	0.9972	0.1250	1.920	0.2100	2.000	4	1	1
773	20.20	61.1000	0.6300	80.1	34.80	0.5940	0.8737	0.8729	0.9967	0.1250	1.920	0.2100	2.000	4	1	1
774	113.00	65.0000	0.4410	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
775	114.20	65.8000	0.4410	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
776	200.40	115.6000	1.3950	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
777	221.50	127.5000	1.3950	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
778	222.00	128.0000	1.3950	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
779	167.00	96.0000	0.4410	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
780	184.00	106.0000	0.4410	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
781	177.80	108.2000	0.4410	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1

Table A-3 (continued)

Point No.	V _C	V _D (ft/hr)	A (in.)	F (cycles/min)	Y (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
782	189.90	109.1000	1.3950	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
783	191.00	110.0000	1.3950	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
784	63.50	110.5000	0.4410	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
785	70.90	123.1000	0.4410	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
786	68.00	118.0000	0.4410	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
787	106.00	182.0000	1.3950	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
788	105.20	182.8000	1.3950	45.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
789	83.10	143.9000	0.4410	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
790	96.40	166.6000	0.4410	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
791	96.00	166.0000	0.4410	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
792	70.40	121.6000	1.3950	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
793	71.50	123.5000	1.3950	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
794	70.40	121.6000	1.3950	75.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
795	161.50	161.5000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
796	171.50	171.5000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
797	164.00	164.0000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
798	157.00	157.0000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
799	15.50	24.4000	0.5000	140.0	10.70	0.6370	1.0000	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
800	15.50	24.4000	0.7500	120.0	10.60	0.6370	1.0100	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
801	15.50	24.4000	1.1250	80.0	10.60	0.6370	1.0100	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
802	24.80	38.9000	0.5000	138.0	10.30	0.6370	1.0300	0.8070	1.0030	0.0313	2.000	0.2300	0.980	2	1	1
803	24.80	38.9000	0.7500	117.0	10.70	0.6370	1.0050	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
804	24.80	38.9000	1.1250	74.0	10.60	0.6370	1.0050	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
805	37.20	58.5000	0.5000	55.0	10.50	0.6370	1.0200	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
806	37.20	58.5000	0.7500	55.0	10.70	0.6370	1.0050	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
807	37.20	58.5000	1.1250	55.0	10.70	0.6370	1.0050	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
808	49.60	78.0000	0.5000	40.0	10.40	0.6370	1.0250	0.8070	1.0030	0.0313	2.000	0.2300	0.980	2	1	1
809	49.60	78.0000	0.7500	44.0	10.40	0.6370	1.0250	0.8070	1.0030	0.0313	2.000	0.2300	0.980	2	1	1
810	49.60	78.0000	1.1250	44.0	10.70	0.6370	1.0020	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
811	37.20	58.5000	0.7500	15.0	10.60	0.6370	1.0100	0.8070	1.0020	0.0313	2.000	0.2300	0.980	2	1	1
812	44.50	89.1000	0.5000	110.0	17.20	1.4000	1.0900	1.4110	1.0790	0.1250	3.000	0.2300	2.000	2	1	1
813	142.80	71.1000	0.5000	90.0	17.20	1.4000	1.0900	1.4110	1.0790	0.1250	3.000	0.2300	2.000	2	1	1
814	46.30	23.3000	1.0000	80.0	17.20	1.4000	1.0900	1.4110	1.0790	0.1250	3.000	0.2300	2.000	2	1	1
815	107.00	53.5000	1.0000	75.0	17.20	1.4000	1.0900	1.4110	1.0790	0.1250	3.000	0.2300	2.000	2	1	1
816	111.50	55.6000	1.5000	46.6	17.20	1.4000	1.0900	1.4110	1.0790	0.1250	3.000	0.2300	2.000	2	1	1
817	85.60	171.2000	1.5000	42.6	17.20	1.4000	1.0900	1.4110	1.0790	0.1250	3.000	0.2300	2.000	2	1	1
818	86.60	151.8000	0.5000	122.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
819	98.00	171.0000	1.0000	85.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
820	136.00	238.0000	1.0000	60.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
821	40.10	70.2000	0.5000	66.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
	(ft/hr)		(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
822	24.40	42.5000	1.0000	65.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
823	53.50	93.6000	1.0000	50.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
824	60.90	106.2000	1.0000	40.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
825	72.90	127.8000	0.5000	70.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
826	72.90	127.8000	0.5000	50.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
827	72.90	127.8000	1.0000	65.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
828	68.00	119.2000	1.0000	65.0	16.50	1.5700	1.0300	1.3660	1.0020	0.1250	3.000	0.2300	2.000	1	2	31
829	39.00	18.5000	0.4330	160.0	10.10	2.1300	1.0300	0.8450	1.0020	0.1181	1.575	0.2300	1.968	1	1	1
830	31.20	14.5000	0.4330	165.0	10.10	2.1300	1.0300	0.8450	1.0020	0.1181	1.575	0.2300	1.968	1	1	1
831	23.20	11.6300	0.4330	170.0	10.10	2.1300	1.0300	0.8450	1.0020	0.1181	1.575	0.2300	1.968	1	1	1
832	20.40	10.3300	0.4330	180.0	10.10	2.1300	1.0300	0.8450	1.0020	0.1181	1.575	0.2300	1.968	1	1	1
833	15.70	7.9000	0.4330	240.0	10.10	2.1300	1.0300	0.8450	1.0020	0.1181	1.575	0.2300	1.968	1	1	1
834	16.50	8.3300	0.4330	240.0	10.10	2.1300	1.0300	0.8450	1.0020	0.1181	1.575	0.2300	1.968	1	1	1
835	15.70	7.9000	0.4330	270.0	10.10	2.1300	1.0300	0.8450	1.0020	0.1181	1.575	0.2300	1.968	1	1	1
836	41.00	20.5000	1.5750	66.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
837	30.70	15.4000	1.5750	70.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
838	20.60	10.2000	1.5750	75.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
839	10.30	5.1000	1.5750	85.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
840	15.40	7.6000	0.3940	330.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
841	20.60	10.2000	0.3940	310.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
842	41.00	20.5000	0.3940	273.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
843	15.40	7.6000	0.7870	185.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
844	20.60	10.2000	0.7870	180.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
845	41.00	20.5000	0.7870	160.0	10.10	2.1300	1.0300	0.8450	1.0020	0.0786	1.575	0.2300	1.968	1	1	1
851	15.80	21.5000	2.5000	52.5	8.20	0.6370	1.4600	0.8070	1.0920	0.1067	1.500	0.2880	1.500	2	1	4
852	20.90	20.9000	3.0000	45.0	8.20	0.6370	1.4600	0.8070	1.0920	0.1067	1.500	0.2880	1.500	2	1	4
853	15.10	8.5000	1.5750	67.0	10.00	2.1400	1.0000	0.8510	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
854	23.60	11.8000	1.5750	49.6	10.00	2.1400	1.0000	0.8510	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
855	31.50	15.8000	1.5750	43.5	10.00	2.1400	1.0000	0.8510	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
856	15.10	8.5000	1.5750	69.4	10.10	2.0100	1.0000	0.8430	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
857	23.60	11.8000	1.5750	55.6	10.10	2.0100	1.0000	0.8430	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
858	31.50	15.8000	1.5750	49.6	10.10	2.0100	1.0000	0.8430	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
859	39.40	19.7000	1.5750	47.9	10.10	2.0100	1.0000	0.8430	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
860	47.20	23.7000	1.5750	40.0	10.10	2.0100	1.0000	0.8430	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
861	5.90	23.8000	1.5750	105.0	11.30	1.6800	1.0000	0.8010	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
862	6.10	16.3000	1.5750	105.0	10.50	1.8300	1.0000	0.8200	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
863	5.90	11.8000	1.5750	105.0	10.50	2.1400	1.0000	0.8420	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
864	7.40	29.6000	1.5750	100.0	11.30	1.6800	1.0000	0.8010	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
865	6.90	18.4000	1.5750	100.0	10.50	1.8300	1.0000	0.8200	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
866	6.60	13.1000	1.5750	100.0	10.50	2.1400	1.0000	0.8420	1.0000	0.1181	1.575	0.2300	1.968	2	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D (ft/hr)	A (in.)	F (cycles/min)	Y (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Cr*
867	5.20	42.0000	1.5750	95.0	24.10	1.6300	1.0000	0.7780	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
868	10.50	42.0000	1.5750	95.0	11.30	1.6800	1.0000	0.8010	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
869	10.00	26.8000	1.5750	95.0	10.50	1.8300	1.0000	0.8200	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
870	8.70	17.7000	1.5750	95.0	10.50	2.1400	1.0000	0.8420	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
871	13.10	52.4000	1.5750	93.0	11.30	1.6800	1.0000	0.8010	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
872	13.10	35.0000	1.5750	93.0	10.50	1.8300	1.0000	0.8201	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
873	10.80	21.6000	1.5750	93.0	10.50	2.1400	1.0000	0.8420	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
874	5.70	45.9000	1.5750	93.0	24.10	1.6300	1.0000	0.7780	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
875	67.60	33.8000	0.4330	230.0	24.10	1.6300	1.0000	0.7780	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
876	34.00	17.0000	0.4330	230.0	11.30	1.6800	1.0000	0.8010	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
877	22.60	11.3000	0.4330	230.0	10.50	1.8300	1.0000	0.8200	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
878	16.90	8.4000	0.4330	230.0	10.50	2.1400	1.0000	0.8420	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
879	84.20	42.1000	0.4330	215.0	24.10	1.6300	1.0000	0.7780	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
880	46.60	23.3000	0.4330	215.0	11.30	1.6800	1.0000	0.8010	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
881	29.20	14.6000	0.4330	215.0	10.50	1.8300	1.0000	0.8200	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
882	18.30	9.2000	0.4330	215.0	10.50	2.1400	1.0000	0.8420	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
883	99.80	49.9000	0.4330	200.0	24.10	1.6300	1.0000	0.7780	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
884	58.00	29.0000	0.4330	200.0	11.30	1.6800	1.0000	0.8010	1.0000	0.1181	1.575	0.2300	1.968	1	1	1
885	38.40	19.2000	0.4330	200.0	10.50	1.8300	1.0000	0.8200	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
886	21.40	10.7000	0.4330	200.0	10.50	2.1400	1.0000	0.8420	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
887	108.00	54.0000	0.4330	190.0	24.10	1.6300	1.0000	0.7780	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
888	64.40	32.2000	0.4330	190.0	11.30	1.6800	1.0000	0.8010	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
889	45.20	22.6000	0.4330	190.0	10.50	1.8300	1.0000	0.8200	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
890	23.00	11.5000	0.4330	190.0	10.50	2.1400	1.0000	0.8420	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
891	117.20	58.6000	0.4330	180.0	24.10	1.6300	1.0000	0.7780	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
892	74.00	37.0000	0.4330	180.0	11.30	1.6800	1.0000	0.8010	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
893	52.40	26.2000	0.4330	180.0	10.50	1.8300	1.0000	0.8200	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
894	24.80	12.4000	0.4330	180.0	10.50	2.1400	1.0000	0.8420	1.0000	0.1181	1.575	0.2300	1.968	2	1	1
895	7.60	17.0000	0.8000	80.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
896	10.00	22.4000	0.8000	70.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
897	12.90	28.6000	0.8000	60.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
898	16.80	33.8000	0.8000	50.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
899	12.40	27.7000	0.8000	35.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
900	8.80	24.2000	0.8000	80.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
901	11.50	31.6000	0.8000	60.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
902	13.00	35.4000	0.8000	35.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
903	12.30	30.7000	0.8000	80.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
904	16.40	40.5000	0.8000	60.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
905	19.50	48.6000	0.8000	50.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
906	20.10	50.1000	0.8000	40.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
907	14.70	36.9000	0.8000	80.0	9.30	2.1200	1.3900	0.8449	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
908	17.00	42.4000	0.8000	70.0	9.30	2.1200	1.3900	0.8449	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
909	20.90	52.0000	0.8000	60.0	9.30	2.1200	1.3900	0.8449	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
910	25.10	62.9000	0.8000	50.0	9.30	2.1200	1.3900	0.8449	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
911	11.90	29.5000	0.8000	80.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
912	20.70	51.8000	0.8000	50.0	10.40	2.7900	1.3900	0.9190	1.0770	0.1250	1.920	0.2300	2.000	2	1	1
913	51.70	49.5000	0.7500	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
914	39.50	60.0000	0.7500	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
915	20.20	69.0000	0.7500	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
916	57.90	54.4000	0.7500	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
917	69.80	54.6000	0.7500	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
918	98.60	49.1000	0.7500	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
919	143.00	37.7000	0.7500	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
920	36.50	33.5000	0.7500	94.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
921	49.20	28.6000	0.7500	94.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
922	78.80	22.8000	0.7500	94.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
923	15.30	41.0000	0.7500	94.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
924	58.20	63.0000	0.7500	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
925	78.80	60.1000	0.7500	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
926	133.00	33.8000	0.7500	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
927	20.50	72.9000	0.7500	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
928	39.50	42.6000	0.7500	78.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
929	60.00	40.1000	0.7500	78.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
930	97.50	31.1000	0.7500	78.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
931	13.50	54.9000	0.7500	78.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
932	20.00	78.8000	0.7500	50.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
933	60.10	63.5000	0.7500	50.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
934	100.40	50.1000	0.7500	50.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
935	39.60	19.2000	0.7500	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
936	19.70	26.1000	0.7500	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
937	11.40	28.6000	0.7500	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
938	18.90	22.0000	0.7500	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
939	70.00	10.2000	0.7500	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
940	20.40	24.6000	0.7500	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
941	54.20	14.8000	0.7500	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
942	100.40	15.8000	0.7500	94.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
943	29.50	15.1000	0.7500	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
944	39.90	50.5000	0.7500	20.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
945	38.80	14.8000	1.6000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
946	20.10	22.7000	1.6000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1

Table A-3 (continued)

Point No.	V _C (ft./hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
947	10.50	25.9000	1.6000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
948	59.10	11.3000	1.6000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
949	59.00	36.0000	1.6000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
950	41.30	38.9000	1.6000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
951	19.70	46.9000	1.6000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
952	88.70	28.8000	1.6000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
953	87.10	51.9000	1.6000	25.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
954	58.30	59.1000	1.6000	25.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
955	30.40	66.9000	1.6000	25.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
956	30.55	3.4500	1.6000	94.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
957	10.64	8.8600	1.6000	94.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
958	38.80	69.9000	0.3750	94.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
959	59.10	58.0000	0.3750	94.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
960	59.10	50.0000	0.3750	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
961	79.20	47.4000	0.3750	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
962	143.30	30.5000	0.3750	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
963	71.80	19.5000	0.3750	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
964	15.50	65.1000	0.3750	122.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
965	15.50	54.1000	0.3750	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
966	30.00	53.0000	0.3750	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
967	59.90	42.4000	0.3750	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
968	101.50	31.0000	0.3750	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
969	152.40	22.2000	0.3750	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
970	34.90	33.3000	0.3750	180.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
971	15.50	41.4000	0.3750	180.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
972	23.20	37.8000	0.3750	180.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
973	58.40	28.1000	0.3750	180.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
974	98.50	12.8000	0.3750	180.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
975	40.10	26.6000	0.3750	200.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
976	20.70	37.2000	0.3750	200.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
977	20.60	31.9000	0.3750	200.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
978	58.30	19.2000	0.3750	200.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
979	99.20	9.6000	0.3750	200.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
980	11.00	39.8000	0.3750	200.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
981	10.80	15.1000	1.1250	110.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
982	20.30	13.3000	1.1250	110.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
983	39.64	6.4600	1.1250	110.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
984	37.40	33.7000	1.1250	71.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
985	23.10	31.0000	1.1250	71.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
986	59.20	20.6000	1.1250	71.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	C†*
987	78.65	15.9500	1.1250	70.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
988	50.30	63.6000	1.1250	22.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
989	64.30	57.3000	1.1250	22.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
990	77.10	52.6000	1.1250	22.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
991	99.30	42.9000	1.1250	22.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
992	31.30	76.0000	1.1250	22.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
993	31.40	62.0000	1.1250	14.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
994	49.30	53.2000	1.1250	14.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
995	70.60	46.9000	1.1250	14.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
996	20.90	62.9000	1.1250	14.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
997	98.50	29.0000	1.1250	14.5	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	1.000	4	1	1
998	49.20	24.6000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
999	26.00	31.5000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
1000	16.40	32.8000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
1001	101.60	13.4000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
1002	113.00	34.7000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
1003	12.00	53.1000	1.1250	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
1004	40.40	46.2000	1.1250	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
1005	99.60	27.1000	1.1250	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
1006	11.72	10.8800	1.1250	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
1007	16.70	14.8000	1.1250	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	0.500	4	1	1
1008	60.20	39.4000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1009	40.10	46.8000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1010	21.40	55.6000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1011	98.50	26.6000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1012	49.07	14.1300	1.1250	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1013	32.80	21.6000	1.1250	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1014	21.30	24.7000	1.1250	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1015	12.30	32.6000	1.1250	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1016	50.60	68.9000	1.1250	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1017	65.00	60.9000	1.1250	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1018	77.90	70.7000	1.1250	25.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1019	36.70	32.0000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1020	45.20	44.5000	1.0000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1021	30.60	30.5000	1.0000	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1022	21.60	21.0000	1.0000	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1023	54.20	52.2000	1.0000	50.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	2.000	4	1	1
1024	46.20	52.0000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	3.000	4	1	1
1025	65.50	47.6000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	3.000	4	1	1
1026	30.10	26.2000	1.1250	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	3.000	4	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
1027	29.60	64.9000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	4.000	4	1	1
1028	60.10	54.2000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	4.000	4	1	1
1029	15.80	70.3000	1.1250	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	4.000	4	1	1
1030	15.70	41.5000	1.1250	90.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0400	2.000	0.2270	4.000	4	1	1
1031	41.10	92.4000	0.6250	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1032	95.00	53.6000	0.6250	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1033	88.90	78.7000	0.6250	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1034	136.20	65.1000	0.6250	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1035	185.70	54.2000	0.6250	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1036	65.60	63.8000	0.6250	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1037	24.60	70.8000	0.6250	110.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1038	40.30	64.1000	0.6250	110.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1039	68.90	53.8000	0.6250	110.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1040	24.20	26.2000	0.6250	180.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1041	99.60	96.6000	0.6250	50.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	1.000	4	1	1
1042	102.60	102.6000	1.0000	45.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	2.000	4	1	1
1043	66.60	65.2000	1.0000	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	2.000	4	1	1
1044	34.90	34.9000	1.0000	120.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	2.000	4	1	1
1045	25.60	25.2000	1.0000	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1250	2.000	0.2420	2.000	4	1	1
1046	118.40	118.2000	1.0000	50.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1047	40.30	38.4000	1.0000	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1048	69.00	68.5000	1.0000	75.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1049	29.00	29.1000	1.0000	120.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1050	127.70	127.6000	1.0000	35.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1051	60.10	61.0000	1.0000	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1052	29.70	73.9000	1.0000	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1053	118.60	118.7000	1.0000	30.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1054	122.30	122.3000	1.0000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1055	27.40	27.1000	1.0000	120.0	42.00	1.3200	0.9100	0.7510	0.9980	0.1860	2.000	0.2240	2.000	4	1	1
1056	74.90	73.5000	1.0000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.2350	2.000	4	1	1
1057	49.20	48.2000	1.0000	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.2350	2.000	4	1	1
1058	56.00	54.9000	1.0000	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.2350	2.000	4	1	1
1059	33.30	33.3000	1.0000	120.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.2350	2.000	4	1	1
1060	91.10	89.4000	1.0000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.2350	2.000	4	1	1
1061	25.10	24.6000	1.0000	140.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.2350	2.000	4	1	1
1062	34.10	34.5000	1.0000	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0270	2.000	0.2290	2.000	4	1	1
1063	45.80	45.0000	1.0000	75.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0270	2.000	0.2290	2.000	4	1	1
1064	28.60	28.6000	1.0000	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0270	2.000	0.2290	2.000	4	1	1
1065	23.60	23.2000	1.0000	70.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0200	2.000	0.2260	2.000	4	1	1
1066	21.30	21.2000	1.0000	90.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0200	2.000	0.2260	2.000	4	1	1

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
	(ft/hr)		(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
1067	21.90	20.2000	1.0000	120.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0200	2.000	0.2260	2.000	4	1	1
1068	82.30	80.8000	1.0000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.4100	2.000	4	1	1
1069	47.30	46.5000	1.0000	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.4100	2.000	4	1	1
1070	31.20	29.2000	1.0000	144.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.4100	2.000	4	1	1
1071	80.60	98.6000	1.0000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.4100	2.000	4	1	1
1072	67.70	70.6000	1.0000	50.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.1570	2.000	4	1	1
1073	27.40	26.7000	1.0000	90.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.1570	2.000	4	1	1
1074	45.20	44.4000	1.0000	70.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.1570	2.000	4	1	1
1075	48.20	47.4000	1.0000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.0810	2.000	4	1	1
1076	21.60	21.2000	1.0000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.0810	2.000	4	1	1
1077	30.10	29.5000	1.0000	50.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.0810	2.000	4	1	1
1078	85.80	85.8000	1.0000	50.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.3150	2.000	4	1	1
1079	51.30	49.2000	1.0000	90.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.3150	2.000	4	1	1
1080	36.50	36.4000	1.0000	120.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0790	2.000	0.3150	2.000	4	1	1
1081	62.10	61.0000	1.0000	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.3450	2.000	4	1	1
1082	103.20	104.0000	1.0000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.3450	2.000	4	1	1
1083	41.30	39.4000	1.0000	120.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.3450	2.000	4	1	1
1084	48.20	47.4000	1.0000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.1240	2.000	4	1	1
1085	80.20	80.2000	1.0000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.1240	2.000	4	1	1
1086	25.60	25.2000	1.0000	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.1240	2.000	4	1	1
1087	60.10	59.7000	1.0000	60.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.1240	2.000	4	1	1
1088	79.90	79.2000	1.0000	40.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.1240	2.000	4	1	1
1089	34.50	34.2000	1.0000	80.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.1240	2.000	4	1	1
1090	25.00	25.0000	1.0000	100.0	42.00	1.3200	0.9100	0.7510	0.9980	0.0940	2.000	0.1240	2.000	4	1	1
1091	10.20	25.6000	0.8000	80.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1092	12.60	31.3000	0.8000	70.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1093	15.40	38.6000	0.8000	60.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1094	18.60	46.5000	0.8000	50.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1095	20.70	51.8000	0.8000	40.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1096	7.92	17.2800	0.8000	80.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1097	11.40	25.4000	0.8000	70.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1098	13.50	30.0000	0.8000	60.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1099	15.10	33.4000	0.8000	50.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1100	16.00	35.5000	0.8000	40.0	10.00	2.8300	1.6200	0.9250	1.1040	0.1250	1.920	0.2300	2.000	2	1	1
1133	27.40	68.8000	0.8000	50.0	9.80	1.5200	1.2000	0.8400	1.0610	0.1250	1.920	0.2300	2.000	2	1	1
1134	20.10	50.4000	0.8000	60.0	9.80	1.5200	1.2000	0.8400	1.0610	0.1250	1.920	0.2300	2.000	2	1	1
1135	13.45	36.8000	0.8000	70.0	9.80	1.5200	1.2000	0.8400	1.0610	0.1250	1.920	0.2300	2.000	2	1	1
1136	25.50	63.5000	0.8000	50.0	10.20	1.5200	1.1700	0.8400	1.0610	0.1250	1.920	0.2300	2.000	2	1	1
1137	20.90	52.0000	0.8000	60.0	10.20	1.5200	1.1700	0.8400	1.0610	0.1250	1.920	0.2300	2.000	2	1	1
1138	17.00	42.4000	0.8000	70.0	10.20	1.5200	1.1700	0.8400	1.0610	0.1250	1.920	0.2300	2.000	2	1	1

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ_D	μ_C	ρ_D	ρ_C	d	D	ϵ	S	Tr*	CP*	Ct*
	(ft/hr)	(in.)	(cycles/min)	(dynes/cm)	(centipoises)	(gm/cm ³)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)
1139	13.70	34.4000	0.8000	80.0	10.20	1.5200	1.1700	0.8400	1.0610	0.1250	1.920	0.2300	2.000	2	1	1
1140	73.50	73.5000	1.0000	33.0	20.80	1.2700	3.0600	0.7940	1.2440	0.1250	1.920	0.2300	2.000	2	1	1
1141	66.90	66.9000	1.0000	38.5	20.80	1.2700	3.0600	0.7940	1.2440	0.1250	1.920	0.2300	2.000	2	1	1
1142	48.50	48.5000	1.0000	50.0	20.80	1.2700	3.0600	0.7940	1.2440	0.1250	1.920	0.2300	2.000	2	1	1
1143	43.50	43.5000	1.0000	60.0	20.80	1.2700	3.0600	0.7940	1.2440	0.1250	1.920	0.2300	2.000	2	1	1
1144	33.50	33.4000	1.0000	70.0	20.80	1.2700	3.0600	0.7940	1.2440	0.1250	1.920	0.2300	2.000	2	1	1
1145	23.50	23.4000	1.0000	80.0	20.80	1.2700	3.0600	0.7940	1.2440	0.1250	1.920	0.2300	2.000	2	1	1
1146	47.00	100.0000	1.0000	40.0	20.80	1.2700	2.7300	0.7940	1.1120	0.1250	1.920	0.2300	2.000	3	1	1
1147	34.40	85.8000	1.0000	50.0	20.80	1.2700	2.7300	0.7940	1.1120	0.1250	1.920	0.2300	2.000	3	1	1
1148	26.60	66.3000	1.0000	65.0	20.80	1.2700	2.7300	0.7940	1.1120	0.1250	1.920	0.2300	2.000	3	1	1
1149	18.83	47.0700	1.0000	78.0	20.80	1.2700	2.7300	0.7940	1.1120	0.1250	1.920	0.2300	2.000	3	1	1
1150	9.38	23.4200	1.0000	97.8	20.80	1.2700	2.7300	0.7940	1.1120	0.1250	1.920	0.2300	2.000	3	1	1
1151	45.90	114.3000	1.0000	40.0	20.80	1.2700	0.9610	0.7940	1.0000	0.1250	1.920	0.2300	2.000	1	1	1
1152	34.40	85.8000	1.0000	55.0	20.80	1.2700	0.9610	0.7940	1.0000	0.1250	1.920	0.2300	2.000	1	1	1
1153	22.90	57.3000	1.0000	70.0	20.80	1.2700	0.9610	0.7940	1.0000	0.1250	1.920	0.2300	2.000	1	1	1
1154	11.49	28.6100	1.0000	80.0	20.80	1.2700	0.9610	0.7940	1.0000	0.1250	1.920	0.2300	2.000	1	1	1
1155	4.04	4.0400	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1156	4.04	6.0500	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1157	4.04	10.1000	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1158	4.04	16.1200	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1159	4.04	24.2000	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1160	4.04	40.4000	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1161	4.04	48.4000	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1162	10.10	6.0500	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1163	10.10	8.0800	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1164	10.10	10.1000	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1165	10.10	20.2000	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1166	10.10	30.3000	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1167	20.20	6.0500	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1168	20.20	10.1000	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1169	20.20	14.1200	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1170	20.20	17.0300	0.3500	17.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1171	4.04	10.1000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1172	4.04	20.2000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1173	4.04	30.3000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1174	4.04	40.4000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1175	4.04	60.5000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1176	10.10	10.1000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1177	10.10	20.2000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1178	10.10	30.3000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D (ft/hr)	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
1179	10.10	40.4000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1180	10.10	60.5000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1181	4.04	20.2000	0.1500	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1182	4.04	20.2000	0.2000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1183	4.04	20.2000	0.3000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1184	4.04	20.2000	0.4000	72.0	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1185	4.04	20.2000	0.1500	35.5	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1186	4.04	20.2000	0.2000	35.5	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1187	4.04	20.2000	0.3500	35.5	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1188	4.04	20.2000	0.4500	35.5	5.00	3.4400	1.0100	0.8230	0.9900	0.0400	1.000	0.0880	2.000	1	1	32
1189	30.30	10.1000	0.2000	72.0	4.90	1.0100	3.4300	0.9890	0.8230	0.0400	1.000	0.0880	2.000	1	2	32
1190	30.30	10.1000	0.4500	35.5	4.90	1.0100	3.4300	0.9890	0.8230	0.0400	1.000	0.0880	2.000	1	2	32
1191	39.80	46.1000	0.1750	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1192	41.80	6.8700	0.1242	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1193	40.40	16.6900	0.1322	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1194	40.40	104.1000	0.2640	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1195	41.80	57.2000	0.2020	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1196	39.90	55.6000	0.1790	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1197	40.80	264.5000	0.4350	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1198	40.00	41.7000	0.1556	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1199	40.70	31.8000	0.1478	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1200	41.70	82.4000	0.2260	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1201	41.40	203.7000	0.3810	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1202	41.20	149.3000	0.3030	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1203	41.80	94.6000	0.2830	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1204	41.60	134.7000	0.3340	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1205	40.40	49.5000	0.2040	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1206	40.90	179.1000	0.3980	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1207	41.00	211.8000	0.4440	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1208	40.30	213.2000	0.4490	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1209	39.90	363.6000	0.1758	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1210	41.60	201.2000	0.6910	35.7	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1211	39.80	26.9000	0.2560	35.7	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1212	40.20	174.9000	0.7240	35.7	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1213	40.00	149.6000	0.6060	35.7	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1214	41.60	52.0000	0.2940	35.7	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1215	41.10	17.6500	0.5450	17.5	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1216	41.70	31.2000	0.6370	17.5	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1217	39.80	47.3000	0.7080	17.5	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1218	40.40	107.7000	1.0720	17.5	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D (ft/hr)	A (in.)	F (cycles/min)	γ (dynes/cm)	μ_D (centipoises)	μ_C (centipoises)	ρ_D (gm/cm ³)	ρ_C (gm/cm ³)	d (in.)	D (in.)	ϵ	S (in.)	Tr*	CP*	Ct*
1219	20.73	33.0000	0.1010	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1220	19.92	103.4000	0.2100	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1221	19.47	66.8000	0.1710	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1222	18.95	232.3000	0.3580	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1223	19.15	8.2800	0.0894	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1224	20.52	177.9000	0.3030	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1225	20.16	48.7000	0.1593	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1226	20.81	83.0000	0.1951	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1227	20.60	122.0000	0.2460	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1228	20.48	180.8000	0.3140	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1229	20.16	200.3000	0.3380	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1230	20.32	36.6000	0.4210	17.5	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1231	78.30	35.1000	0.2080	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1232	80.80	41.0000	0.2670	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1233	82.90	122.4000	0.4500	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1234	116.60	21.2100	0.2340	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1235	120.80	42.3000	0.4050	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1236	117.60	13.8200	0.2295	72.6	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1237	40.90	352.0000	0.7700	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1238	41.60	118.0000	2.9000	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1239	40.50	187.0000	2.1800	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1240	80.50	182.2000	2.1800	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1241	120.80	157.0000	2.1800	59.9	10.10	0.6140	1.0600	0.8050	0.9960	0.0313	1.000	0.2500	2.000	4	1	1
1242	40.11	13.3900	1.0000	104.0	16.00	1.3000	1.9600	0.8020	1.1950	0.1250	2.000	0.2300	2.000	2	1	1
1243	80.20	26.8000	1.0000	85.0	16.00	1.3000	1.9600	0.8020	1.1950	0.1250	2.000	0.2300	2.000	2	1	1
1244	110.20	36.8000	1.0000	65.0	16.00	1.3000	1.9600	0.8020	1.1950	0.1250	2.000	0.2300	2.000	2	1	1
1245	120.20	40.1000	1.0000	55.0	16.00	1.3000	1.9600	0.8020	1.1950	0.1250	2.000	0.2300	2.000	2	1	1
1246	35.68	17.8200	1.0000	90.0	16.00	1.3000	1.9600	0.8020	1.1950	0.1250	2.000	0.2300	2.000	2	1	1
1247	89.30	44.5000	1.0000	70.0	16.00	1.3000	1.9600	0.8020	1.1950	0.1250	2.000	0.2300	2.000	2	1	1
1248	106.80	53.5000	1.0000	50.0	16.00	1.3000	1.9600	0.8020	1.1950	0.1250	2.000	0.2300	2.000	2	1	1
1249	115.90	57.9000	1.0000	35.0	16.00	1.3000	1.9600	0.8020	1.1950	0.1250	2.000	0.2300	2.000	2	1	1
1250	130.30	43.5000	1.0000	45.0	16.00	1.3000	1.9600	0.8020	1.1950	0.1250	2.000	0.2300	2.000	2	1	1
1251	23.45	23.4500	1.0000	85.0	16.00	1.3000	1.2100	0.8020	1.1180	0.1250	2.000	0.2300	2.000	2	1	1
1252	40.05	40.0500	1.0000	60.0	16.00	1.3000	1.2100	0.8020	1.1180	0.1250	2.000	0.2300	2.000	2	1	1
1253	60.10	60.1000	1.0000	40.0	16.00	1.3000	1.2100	0.8020	1.1180	0.1250	2.000	0.2300	2.000	2	1	1
1254	80.15	80.1500	1.0000	35.0	16.00	1.3000	1.2100	0.8020	1.1180	0.1250	2.000	0.2300	2.000	2	1	1
1255	86.90	86.9000	1.0000	32.0	16.00	1.3000	1.2100	0.8020	1.1180	0.1250	2.000	0.2300	2.000	2	1	1
1256	86.90	86.9000	0.5000	35.0	16.00	1.3000	1.2100	0.8020	1.1180	0.1250	2.000	0.2300	2.000	2	1	1
1257	80.15	80.1500	0.5000	95.0	16.00	1.3000	1.2100	0.8020	1.1180	0.1250	2.000	0.2300	2.000	2	1	1
1258	85.15	85.1500	0.7500	70.0	16.00	1.3000	1.2100	0.8020	1.1180	0.1250	2.000	0.2300	2.000	2	1	1

Table A-3 (continued)

Point No.	V _C	V _D	A	F	Y	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
	(ft/hr)		(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
1259	11.49	28.6100	1.0000	70.0	16.00	1.3000	1.5900	0.8020	1.1120	0.1250	2.000	0.2300	2.000	4	1	1
1260	19.10	47.8000	1.0000	55.0	16.00	1.3000	1.5900	0.8020	1.1120	0.1250	2.000	0.2300	2.000	4	1	1
1261	30.60	76.4000	1.0000	22.0	16.00	1.3000	1.5900	0.8020	1.1120	0.1250	2.000	0.2300	2.000	4	1	1
1262	10.70	42.8000	1.0000	75.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1263	13.38	52.5200	1.0000	70.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1264	18.72	74.8800	1.0000	45.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1265	26.70	107.1000	1.0000	35.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1266	8.02	32.0800	1.0000	70.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1267	10.70	42.8000	1.0000	60.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1268	16.02	64.0800	1.0000	40.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1269	21.40	85.6000	1.0000	25.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1270	10.70	42.8000	1.0000	65.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1271	16.02	64.0800	1.0000	45.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1272	18.72	74.8800	1.0000	35.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1273	8.02	31.0800	1.0000	80.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1274	12.02	48.0800	1.0000	65.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1275	16.02	64.0800	1.0000	50.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1276	21.40	85.6000	1.0000	45.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1277	29.40	117.6000	1.0000	35.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1278	8.02	31.0800	1.0000	72.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1279	21.40	85.6000	1.0000	25.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1280	10.70	42.8000	1.0000	85.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1281	18.72	74.8800	1.0000	50.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1282	29.40	117.6000	1.0000	35.0	16.00	1.3000	0.9700	0.8020	1.0130	0.1250	2.000	0.2300	2.000	1	1	1
1290	19.50	43.1000	1.0000	70.0	10.50	1.6300	1.1200	0.8140	1.0600	0.1250	2.000	0.2300	2.000	2	1	1
1291	32.80	72.5000	1.0000	50.0	10.50	1.6300	1.1200	0.8140	1.0600	0.1250	2.000	0.2300	2.000	2	1	1
1292	37.00	81.7000	1.0000	30.0	10.50	1.6300	1.1200	0.8140	1.0600	0.1250	2.000	0.2300	2.000	2	1	1
1293	61.90	34.1000	1.0000	70.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1294	79.10	43.6000	1.0000	50.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1295	79.10	43.6000	1.0000	35.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1296	94.60	52.1000	1.0000	25.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1297	61.90	34.1000	0.5000	100.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1298	94.60	52.1000	0.5000	70.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1299	94.60	52.1000	0.5000	50.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1300	53.20	24.1000	1.0000	70.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.2300	2.000	2	2	1
1301	72.50	32.8000	1.0000	50.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.2300	2.000	2	2	1
1302	104.00	46.9000	1.0000	30.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.2300	2.000	2	2	1
1303	34.10	61.9000	1.0000	70.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.2300	2.000	1	2	1
1304	43.60	79.1000	1.0000	50.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.2300	2.000	1	2	1
1305	52.10	94.6000	1.0000	35.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.2300	2.000	1	2	1

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
	(ft/hr)		(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
1306	52.10	94.6000	1.0000	25.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.2300	2.000	4	1	1
1307	41.00	1.6550	0.2180	11.5	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1308	42.60	46.6000	0.2180	41.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1309	41.00	143.6000	0.3550	52.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1310	7.04	46.4000	0.4040	15.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1311	19.85	155.5000	0.2950	62.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1312	100.50	18.3100	0.8300	13.5	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1313	44.60	50.0000	0.2560	33.5	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1314	23.60	17.3800	0.0950	35.5	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1315	39.20	50.9000	0.3950	22.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1316	13.64	42.1000	0.3950	12.2	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1317	11.08	13.6600	0.2560	6.8	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1318	88.90	40.5000	0.2900	45.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1319	12.40	67.5000	0.1320	56.5	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1320	20.05	38.8500	0.3440	41.2	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1321	20.65	33.7000	0.1860	80.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1322	26.05	18.4000	0.2500	100.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1323	13.02	25.4000	0.3190	100.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1324	7.04	16.5500	0.5300	100.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1325	13.65	9.9400	0.5300	100.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1326	18.00	4.5500	0.5250	100.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1327	21.30	1.6550	0.6360	80.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1328	5.79	10.9800	0.7810	80.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1329	4.14	11.1800	0.6650	100.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1
1330	8.10	45.4000	1.0000	60.0	14.50	3.0800	0.9800	0.9500	1.0880	0.1250	3.000	0.2300	2.000	4	1	1
1331	12.30	68.0000	1.0000	45.0	14.50	3.0800	0.9800	0.9500	1.0880	0.1250	3.000	0.2300	2.000	4	1	1
1332	14.20	79.4000	1.0000	40.0	14.50	3.0800	0.9800	0.9500	1.0880	0.1250	3.000	0.2300	2.000	4	1	1
1333	8.10	45.4000	0.6000	75.0	14.50	3.0800	0.9800	0.9500	1.0880	0.1250	3.000	0.2300	2.000	4	1	1
1334	12.30	68.0000	0.6000	65.0	14.50	3.0800	0.9800	0.9500	1.0880	0.1250	3.000	0.2300	2.000	4	1	1
1335	14.20	79.4000	0.6000	60.0	14.50	3.0800	0.9800	0.9500	1.0880	0.1250	3.000	0.2300	2.000	4	1	1
1336	4.10	22.7000	1.5000	65.0	14.50	3.0800	0.9800	0.9500	1.0880	0.1250	3.000	0.2300	2.000	4	1	1
1337	8.10	45.4000	1.5000	45.0	14.50	3.0800	0.9800	0.9500	1.0880	0.1250	3.000	0.2300	2.000	4	1	1
1338	12.30	68.0000	1.5000	35.0	14.50	3.0800	0.9800	0.9500	1.0880	0.1250	3.000	0.2300	2.000	4	1	1
1339	4.10	22.7000	0.6000	95.0	14.50	3.0800	0.9800	0.9500	1.0880	0.0938	3.000	0.2300	2.000	4	1	1
1340	8.10	45.4000	0.6000	85.0	14.50	3.0800	0.9800	0.9500	1.0880	0.0938	3.000	0.2300	2.000	4	1	1
1341	12.30	68.0000	0.6000	65.0	14.50	3.0800	0.9800	0.9500	1.0880	0.0938	3.000	0.2300	2.000	4	1	1
1342	28.10	72.1000	1.0000	85.0	10.60	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1343	30.10	70.1000	0.5000	120.0	10.60	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1344	60.20	140.2000	0.5000	120.0	10.60	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1345	80.70	186.8000	0.5000	120.0	10.60	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
1346	4.45	22.3500	1.0000	95.0	10.60	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1347	9.00	44.5000	1.0000	85.0	10.60	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1348	13.40	66.9000	1.0000	75.0	10.60	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1349	17.90	89.1000	1.0000	65.0	10.60	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1350	4.45	22.3500	1.0000	85.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1351	9.00	44.5000	1.0000	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1352	13.40	66.9000	1.0000	55.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1353	17.90	89.1000	1.0000	45.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1354	9.00	44.5000	1.0000	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1355	26.75	26.7500	1.0000	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1356	35.68	17.8200	1.0000	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1357	4.45	22.3500	0.4400	105.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1358	9.00	44.5000	0.4400	85.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1359	13.40	66.9000	0.4400	75.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1360	17.90	89.1000	0.4400	75.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	2.000	4	1	1
1361	4.45	22.3500	1.0000	80.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	4.000	4	1	1
1362	9.00	44.5000	1.0000	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	4.000	4	1	1
1363	13.40	66.9000	1.0000	45.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	4.000	4	1	1
1364	17.90	89.1000	1.0000	40.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	4.000	4	1	1
1365	4.45	22.3500	1.0000	75.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1875	3.000	0.2300	2.000	4	1	1
1366	9.00	44.5000	1.0000	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1875	3.000	0.2300	2.000	4	1	1
1367	13.40	66.9000	1.0000	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1875	3.000	0.2300	2.000	4	1	1
1368	17.90	89.1000	1.0000	55.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1875	3.000	0.2300	2.000	4	1	1
1369	4.45	22.3500	1.0000	75.0	10.70	2.4000	0.8020	0.8488	0.9995	0.0625	3.000	0.2300	2.000	4	1	1
1370	9.00	44.5000	1.0000	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.0625	3.000	0.2300	2.000	4	1	1
1371	13.40	66.9000	1.0000	45.0	10.70	2.4000	0.8020	0.8488	0.9995	0.0625	3.000	0.2300	2.000	4	1	1
1372	17.90	89.1000	1.0000	45.0	10.70	2.4000	0.8020	0.8488	0.9995	0.0625	3.000	0.2300	2.000	4	1	1
1373	4.45	22.3500	1.0000	85.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	4.000	4	1	1
1374	9.00	44.5000	1.0000	75.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	4.000	4	1	1
1375	13.40	66.9000	1.0000	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	4.000	4	1	1
1376	17.90	89.1000	1.0000	55.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.2300	4.000	4	1	1
1377	4.45	22.3500	0.4400	65.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.1000	4.000	4	1	1
1378	9.00	44.5000	0.4400	45.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.1000	4.000	4	1	1
1379	13.40	66.9000	0.4400	45.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.1000	4.000	4	1	1
1380	17.90	89.1000	0.4400	35.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.1000	4.000	4	1	1
1381	4.45	22.3500	1.0000	55.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.1000	4.000	4	1	1
1382	9.00	44.5000	1.0000	45.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.1000	4.000	4	1	1
1383	4.45	66.9000	1.0000	95.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.4200	2.000	4	1	1
1384	9.00	44.5000	1.0000	75.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.4200	2.000	4	1	1
1385	13.40	66.9000	1.0000	55.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.4200	2.000	4	1	1

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
	(ft/hr)		(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
1386	17.90	89.1000	1.0000	45.0	10.70	2.4000	0.8020	0.8488	0.9995	0.1250	3.000	0.4200	2.000	4	1	1
1387	26.30	33.8500	1.1020	100.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1388	24.50	26.2500	1.1020	111.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1389	26.45	15.9500	1.1020	130.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1390	23.45	17.0000	1.1020	130.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1391	19.42	17.7100	1.1020	131.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1392	16.88	18.4200	1.1020	131.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1393	8.94	23.4500	1.1020	131.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1394	13.40	12.4100	1.1020	149.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1395	16.91	11.5800	1.1020	149.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1396	4.31	17.5000	1.1020	149.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1397	2.88	13.1700	1.1020	160.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1398	15.95	6.4000	1.1020	160.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1399	11.95	7.2600	1.1020	175.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1400	8.94	5.4100	1.1020	187.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1401	5.39	6.9400	1.1020	191.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1402	13.28	4.0500	1.1020	191.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1403	0.84	8.9400	1.1020	202.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1404	28.22	32.9200	1.8900	60.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1405	27.73	31.3900	1.8900	61.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1406	24.51	29.4300	1.8900	65.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1407	25.19	26.9400	1.8900	67.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1408	21.79	21.5800	1.8900	70.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1409	23.75	19.9600	1.8900	71.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1410	26.81	20.6100	1.8900	71.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1411	22.50	22.4500	1.8900	71.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1412	18.47	24.5900	1.8900	71.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1413	22.97	12.6900	1.8900	80.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1414	8.14	21.9700	1.8900	80.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1415	25.24	12.8200	1.8900	80.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1416	12.74	19.2500	1.8900	80.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1417	19.57	16.3000	1.8900	81.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1418	13.86	17.9700	1.8900	81.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1419	9.23	19.3600	1.8900	81.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1420	5.36	17.1300	1.8900	87.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1421	5.76	14.6500	1.8900	87.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1422	24.33	7.7200	1.8900	87.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1423	5.23	17.5300	1.8900	87.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1424	9.68	13.6000	1.8900	87.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1425	19.88	10.0700	1.8900	87.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D (ft/hr)	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
1426	13.08	10.7300	1.8900	89.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1427	4.26	15.6200	1.8900	89.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1428	14.65	10.2300	1.8900	89.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1429	22.63	6.7200	1.8900	89.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1430	18.31	8.6300	1.8900	89.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1431	7.01	9.7300	1.8900	100.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1432	10.33	7.6600	1.8900	100.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1433	15.43	5.7600	1.8900	100.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1434	10.99	0.9100	1.8900	100.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1435	1.24	12.3000	1.8900	100.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1436	2.01	12.3000	1.8900	101.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1437	9.55	6.5400	1.8900	110.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1438	5.89	11.1200	1.8900	111.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1439	3.79	10.3300	1.8900	111.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1440	16.74	3.7900	1.8900	120.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1441	10.78	7.0600	1.8900	120.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1442	10.46	7.1900	1.8900	120.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1443	8.63	8.5000	1.8900	120.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1444	4.97	9.1600	1.8900	120.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1445	4.05	9.1600	1.8900	121.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1446	4.58	6.8000	1.8900	132.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1447	4.39	6.9300	1.8900	141.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1448	23.94	10.3300	2.2440	70.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1449	20.59	13.1600	2.2440	70.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1450	7.64	18.8900	2.2440	71.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1451	18.65	6.5400	2.2440	90.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1452	12.69	7.7400	2.2440	90.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1453	9.42	8.7600	2.2440	90.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1454	4.53	12.4300	2.2440	91.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1455	2.96	11.1200	2.2440	91.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1456	13.34	6.1500	2.2440	100.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1457	7.32	7.0600	2.2440	100.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1458	4.26	9.4200	2.2440	100.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1459	9.23	4.9200	2.2440	131.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1460	1.70	9.5500	2.2440	131.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1461	24.90	27.5500	2.7950	45.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1462	26.94	13.6600	2.7950	50.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1463	20.93	18.5000	2.7950	50.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1464	11.77	25.2400	2.7950	50.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1465	17.34	18.7000	2.7950	51.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D (ft/hr)	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
1466	7.59	23.2800	2.7950	54.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1467	20.27	8.6900	2.7950	55.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1468	10.99	17.1300	2.7950	55.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1469	26.03	4.8400	2.7950	68.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1470	20.59	7.5900	2.7950	68.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1471	16.27	9.6800	2.7950	68.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1472	6.15	13.1300	2.7950	68.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1473	18.65	3.0900	2.7950	91.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1474	7.80	8.6300	2.7950	91.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1475	5.02	10.4600	2.7950	92.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1476	24.90	15.7500	3.1500	45.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1477	22.76	19.1000	3.1500	45.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1478	20.40	22.3100	3.1500	45.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1479	12.30	12.5600	3.1500	54.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1480	19.93	9.4200	3.1500	55.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1481	17.34	10.8600	3.1500	55.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1482	14.65	11.5100	3.1500	55.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1483	11.98	10.8600	3.1500	60.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1484	11.64	10.4100	3.1500	60.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1485	7.61	12.5800	3.1500	60.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1486	4.45	13.8600	3.1500	60.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1487	7.09	9.2900	3.1500	65.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1488	3.71	10.9900	3.1500	65.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1489	5.70	9.1600	3.1500	71.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1490	4.39	8.8900	3.1500	71.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1491	4.26	10.3300	3.1500	71.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1492	2.82	10.9900	3.1500	71.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1493	7.32	7.3200	3.1500	75.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1494	5.00	7.7400	3.1500	75.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1495	2.75	8.8900	3.1500	75.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1496	7.61	6.5400	3.1500	80.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1497	4.03	8.5000	3.1500	80.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1498	4.03	8.1100	3.1500	90.0	33.90	0.4110	1.0100	0.6838	0.9978	0.0788	1.575	0.2300	1.970	4	1	1
1499	17.70	98.5000	0.5500	90.0	16.00	2.6700	0.9400	0.9340	1.0600	0.0850	2.000	0.2100	1.000	3	1	33
1500	19.00	105.8000	0.5500	110.0	16.00	2.6700	0.9400	0.9340	1.0600	0.0850	2.000	0.2100	1.000	3	1	33
1501	16.21	90.1000	0.5500	130.0	16.00	2.6700	0.9400	0.9340	1.0600	0.0850	2.000	0.2100	1.000	3	1	33
1502	118.00	65.1000	1.0000	25.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.1000	2.000	1	1	5
1503	96.40	53.3000	1.0000	35.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.1000	2.000	1	1	5
1504	47.40	26.1000	1.0000	50.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.1000	2.000	1	1	5
1505	72.70	131.8000	1.0000	25.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.1000	2.000	1	2	5

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D (ft/hr)	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C (centipoises)	ρ _D (gm/cm ³)	ρ _C (gm/cm ³)	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
1506	65.10	118.0000	1.0000	35.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.1000	2.000	1	2	5
1507	33.20	60.4000	1.0000	50.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.1000	2.000	1	2	5
1508	14.25	25.8500	1.0000	70.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.1000	2.000	1	2	5
1509	94.60	52.4000	1.0000	25.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1510	79.10	43.9000	1.0000	35.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1511	79.10	34.2000	1.0000	50.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1512	62.00	34.2000	1.0000	70.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1513	52.40	94.6000	1.0000	25.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.2300	2.000	1	2	1
1514	52.40	94.6000	1.0000	35.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.2300	2.000	1	2	1
1515	43.90	79.1000	1.0000	50.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.2300	2.000	1	2	1
1516	34.20	62.0000	1.0000	70.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.2300	2.000	1	2	1
1517	36.20	101.5000	1.0000	50.0	10.50	1.6300	1.1200	0.8140	1.0920	0.1250	2.000	0.2300	2.000	2	1	1
1518	197.50	28.2000	1.0000	50.0	10.50	1.1200	1.6300	1.0920	0.8140	0.1250	2.000	0.2300	2.000	3	2	1
1519	163.90	23.4000	1.0000	30.0	10.50	1.1200	1.6300	1.0920	0.8140	0.1250	2.000	0.1000	2.000	3	2	5
1520	146.20	20.9000	1.0000	50.0	10.50	1.1200	1.6300	1.0920	0.8140	0.1250	2.000	0.1000	2.000	3	2	5
1521	58.40	8.3500	1.0000	70.0	10.50	1.1200	1.6300	1.0920	0.8140	0.1250	2.000	0.1000	2.000	3	2	5
1522	103.40	69.0000	1.0000	35.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1523	69.00	103.4000	1.0000	35.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1250	2.000	0.2300	2.000	1	2	1
1524	166.80	111.2000	1.0000	35.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1875	2.000	0.2300	2.000	1	1	5
1525	121.90	182.8000	1.0000	35.0	10.50	1.0000	1.6300	1.0000	0.8140	0.1875	2.000	0.2300	2.000	1	2	5
1526	31.30	68.9000	1.0000	50.0	13.30	1.7870	1.0000	0.8190	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1527	39.60	87.4000	1.0000	30.0	13.30	1.7870	1.0000	0.8190	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1528	35.40	78.3000	1.0000	50.0	13.30	1.7870	1.0000	0.8190	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1529	40.70	90.4000	1.0000	30.0	13.30	1.7870	1.0000	0.8190	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1530	46.60	155.5000	0.2500	200.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1531	46.60	155.5000	0.2500	166.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1532	46.60	147.8000	0.2500	144.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1533	46.60	132.2000	0.2500	126.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1534	46.60	122.5000	0.2500	108.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1535	46.60	100.1000	0.2500	100.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1536	46.60	80.0000	0.2500	76.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1537	46.60	70.0000	0.2500	66.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1538	46.60	36.9000	0.2500	42.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1539	46.60	14.3900	0.2500	28.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1540	46.60	134.0000	0.5000	240.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1541	46.60	151.8000	0.5000	200.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1542	46.60	159.2000	0.5000	168.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1543	46.60	172.3000	0.5000	140.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1544	46.60	175.0000	0.5000	116.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1545	46.60	162.2000	0.5000	100.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34

Table A-3 (continued)

Point No.	V _C	V _D (ft/hr)	A (in.)	F ($\frac{\text{cycles}}{\text{min}}$)	γ ($\frac{\text{dynes}}{\text{cm}}$)	μ_D (centipoises)	μ_C	ρ_D (gm/cm ³)	ρ_C	d (in.)	D (in.)	ϵ	S (in.)	Tr*	CP*	Ct*
1546	46.60	122.5000	0.5000	62.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1547	46.60	118.7000	0.5000	62.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1548	46.60	75.8000	0.5000	40.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1549	46.60	15.5600	0.5000	20.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1550	46.60	155.6000	1.0000	136.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1551	46.60	178.9000	1.0000	108.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1552	46.60	198.1000	1.0000	86.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1553	46.60	186.7000	1.0000	68.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1554	46.60	178.9000	1.0000	56.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1555	46.60	124.3000	1.0000	40.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1556	46.60	73.9000	1.0000	28.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1557	46.60	57.1000	1.0000	24.0	18.90	22.2000	1.3300	1.4030	0.7800	0.1110	1.002	0.2300	1.938	4	2	34
1558	46.60	5.0500	0.5000	106.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1559	46.60	15.5500	0.5000	88.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1560	46.60	21.7500	0.5000	74.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1561	46.60	24.8500	0.5000	62.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1562	46.60	31.1000	0.5000	50.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1563	46.60	26.8000	0.5000	38.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1564	46.60	18.6800	0.5000	32.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1565	46.60	17.5000	0.5000	30.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1566	46.60	11.6800	0.2500	128.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1567	46.60	16.7100	0.2500	104.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1568	46.60	18.6800	0.2500	64.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1569	46.60	12.0600	0.2500	40.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1570	46.60	10.5000	0.2500	39.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1571	46.60	8.1600	0.2500	34.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1572	46.60	6.6000	0.2500	25.0	18.90	1.3300	22.2000	0.7800	1.4030	0.1110	1.002	0.2300	1.938	4	1	1
1573	89.40	71.0000	0.2180	114.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1574	87.50	40.4000	0.2180	182.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1575	53.95	42.8000	0.2180	152.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1576	19.42	30.1500	0.2180	190.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1577	48.52	34.0000	0.2180	190.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1578	55.40	60.6000	0.2180	137.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1579	87.90	79.1000	0.2180	114.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1580	34.00	17.4900	0.2180	190.0	7.60	0.6050	2.1700	0.8030	1.0460	0.0860	2.000	0.2000	1.895	4	1	1
1581	16.02	10.2000	0.2180	209.0	7.60	0.6050	2.1700	0.8030	1.0460	0.0860	2.000	0.2000	1.895	4	1	1
1582	29.15	54.9000	0.2180	137.0	7.60	0.6050	2.1700	0.8030	1.0460	0.0860	2.000	0.2000	1.895	4	1	1
1583	68.00	63.1000	0.2180	114.0	7.60	0.6050	2.1700	0.8030	1.0460	0.0860	2.000	0.2000	1.895	4	1	1
1584	19.42	15.0500	0.2180	167.0	6.00	0.6050	4.2300	0.8030	1.0730	0.0860	2.000	0.2000	1.895	4	1	1
1585	50.50	45.6000	0.2180	114.0	6.00	0.6050	4.2300	0.8030	1.0730	0.0860	2.000	0.2000	1.895	4	1	1

Table A-3 (continued)

Point No.	V _C	V _D	A	F	γ	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
	(ft/hr)		(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
1586	8.74	8.7400	0.2180	236.0	6.00	0.6050	4.2300	0.8030	1.0730	0.0860	2.000	0.2000	1.895	4	1	1
1587	52.90	59.1000	0.2180	91.0	6.00	0.6050	4.2300	0.8030	1.0730	0.0860	2.000	0.2000	1.895	4	1	1
1588	6.41	7.9600	0.2180	129.0	3.70	0.6050	7.8600	0.8030	1.0920	0.0860	2.000	0.2000	1.895	4	1	1
1589	3.59	4.1800	0.2180	215.0	3.70	0.6050	7.8600	0.8030	1.0920	0.0860	2.000	0.2000	1.895	4	1	1
1590	10.49	9.3300	0.2180	98.8	3.70	0.6050	7.8600	0.8030	1.0920	0.0860	2.000	0.2000	1.895	4	1	1
1591	11.18	15.0500	0.2180	61.0	3.70	0.6050	7.8600	0.8030	1.0920	0.0860	2.000	0.2000	1.895	4	1	1
1592	34.95	44.0000	0.2500	220.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1593	89.40	70.9000	0.2500	172.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1594	53.90	56.4000	0.2180	205.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1595	87.90	77.1000	0.2180	152.0	10.70	0.6050	0.9260	0.8030	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1596	26.70	25.7500	0.2180	198.0	28.00	0.5500	0.9260	0.8920	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1597	59.20	52.9500	0.2180	129.0	28.00	0.5500	0.9260	0.8920	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1598	20.40	20.4000	0.2180	236.0	28.00	0.5500	0.9260	0.8920	0.9940	0.0860	2.000	0.2000	1.895	4	1	1
1601	152.00	152.0000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1602	64.50	64.5000	0.2480	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1603	70.00	70.0000	0.2480	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1604	66.00	66.0000	0.2480	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1605	66.00	66.0000	2.4800	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1606	50.50	50.5000	2.4800	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1607	52.50	52.5000	2.4800	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1608	104.00	104.0000	0.7840	30.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1609	106.50	106.5000	0.7840	30.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1610	137.00	137.0000	0.7840	90.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1611	130.00	130.0000	0.7840	90.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1612	138.00	138.0000	0.7840	90.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1613	292.00	95.0000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1614	290.00	97.0000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1615	279.00	93.0000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1616	288.00	96.0000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1617	68.20	204.8000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1618	65.80	197.2000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1619	66.00	198.0000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1620	66.30	198.7000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1621	70.20	210.8000	0.7840	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1622	51.00	51.0000	0.3310	37.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1623	56.50	56.5000	0.3310	37.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1624	107.50	107.5000	0.3310	82.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1625	108.00	108.0000	0.3310	82.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1626	121.00	53.0000	0.3310	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1627	124.30	54.7000	0.3310	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D (ft/hr)	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C (centipoises)	ρ _D (gm/cm ³)	ρ _C (gm/cm ³)	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Ct*
1628	55.50	126.5000	0.3310	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1629	55.80	127.2000	0.3310	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1630	119.00	119.0000	1.8490	37.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1631	125.00	125.0000	1.8490	37.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1632	38.50	38.5000	1.8490	82.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1633	39.50	39.5000	1.8490	82.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1634	118.10	51.9000	1.8490	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1635	117.60	51.4000	1.8490	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1636	37.50	85.5000	1.8490	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1637	42.00	96.0000	1.8490	60.0	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1638	182.10	79.9000	0.7840	37.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1639	183.00	80.0000	0.7840	37.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1640	71.60	163.4000	0.7840	37.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1641	76.50	174.5000	0.7840	37.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1642	231.50	101.5000	0.7840	82.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1643	241.20	105.8000	0.7840	82.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1644	68.40	155.6000	0.7840	82.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1645	72.50	165.5000	0.7840	82.5	37.60	0.5910	0.9020	1.4540	1.0000	0.1250	1.920	0.2100	2.000	4	1	1
1646	97.00	100.0000	1.0000	50.0	16.00	1.4200	0.9600	0.7570	1.0630	0.1250	2.000	0.2300	2.000	2	1	1
1647	64.00	66.0000	1.0000	70.0	16.00	1.4200	0.9600	0.7570	1.0630	0.1250	2.000	0.2300	2.000	2	1	1
1648	36.10	37.2000	1.0000	90.0	16.00	1.4200	0.9600	0.7570	1.0630	0.1250	2.000	0.2300	2.000	2	1	1
1649	121.00	117.0000	1.0000	50.0	16.00	0.9600	1.4500	1.0630	0.7600	0.1250	2.000	0.1000	2.000	2	2	5
1650	55.30	53.6000	1.0000	70.0	16.00	0.9600	1.4500	1.0630	0.7600	0.1250	2.000	0.1000	2.000	2	2	5
1651	25.70	24.9000	1.0000	90.0	16.00	0.9600	1.4500	1.0630	0.7600	0.1250	2.000	0.1000	2.000	2	2	5
1652	20.80	82.8000	1.0000	30.0	17.10	1.4500	1.0400	0.7600	1.1110	0.1250	2.000	0.2300	2.000	1	1	1
1653	12.70	50.8000	1.0000	50.0	17.10	1.4500	1.0400	0.7600	1.1110	0.1250	2.000	0.2300	2.000	1	1	1
1654	7.40	29.4000	1.0000	70.0	17.10	1.4500	1.0400	0.7600	1.1110	0.1250	2.000	0.2300	2.000	1	1	1
1655	3.00	11.9700	1.0000	90.0	17.10	1.4500	1.0400	0.7600	1.1110	0.1250	2.000	0.2300	2.000	1	1	1
1656	10.00	40.1000	1.0000	30.0	17.10	1.4500	1.0400	0.7600	1.1110	0.1250	2.000	0.1000	2.000	1	1	5
1657	6.95	27.8000	1.0000	50.0	17.10	1.4500	1.0400	0.7600	1.1110	0.1250	2.000	0.1000	2.000	1	1	5
1658	3.66	14.6500	1.0000	70.0	17.10	1.4500	1.0400	0.7600	1.1110	0.1250	2.000	0.1000	2.000	1	1	5
1659	101.70	25.3000	1.0000	50.0	15.80	1.0000	1.4200	0.9970	0.7570	0.1250	2.000	0.1000	2.000	1	2	5
1660	58.80	14.7000	1.0000	70.0	15.80	1.0000	1.4200	0.9970	0.7570	0.1250	2.000	0.1000	2.000	1	2	5
1661	34.65	8.7500	1.0000	90.0	15.80	1.0000	1.4200	0.9970	0.7570	0.1250	2.000	0.1000	2.000	1	2	5
1662	206.20	61.5000	1.0000	50.0	17.10	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	2	1	1
1663	105.10	31.2000	1.0000	70.0	17.10	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	2	1	1
1664	59.73	17.7700	1.0000	90.0	17.10	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	2	1	1
1665	95.90	28.8000	1.0000	70.0	16.50	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	4	1	1
1666	68.40	20.5000	1.0000	90.0	16.50	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	4	1	1
1667	41.10	41.1000	1.0000	70.0	16.50	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	4	1	1

Table A-3 (continued)

Point No.	V _C (ft/hr)	V _D	A (in.)	F (cycles/min)	γ (dynes/cm)	μ _D (centipoises)	μ _C	ρ _D (gm/cm ³)	ρ _C	d (in.)	D (in.)	ε	S (in.)	Tr*	CP*	Cr*
1668	17.83	35.6700	1.0000	70.0	16.50	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	4	1	1
1669	9.59	28.7700	1.0000	70.0	16.50	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	4	1	1
1670	15.06	45.1400	1.0000	50.0	16.50	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	4	1	1
1671	97.60	29.4000	1.0000	70.0	16.50	1.4200	3.4250	0.7650	1.2750	0.1250	2.000	0.2300	2.000	4	1	1
1672	202.50	44.7000	1.0000	70.0	20.40	2.4100	1.0000	0.8700	1.0500	0.1250	2.000	0.2300	2.000	2	1	1
1673	126.20	28.8000	1.0000	90.0	20.40	2.4100	1.0000	0.8700	1.0500	0.1250	2.000	0.2300	2.000	2	1	1
1674	39.40	173.0000	1.0000	30.0	20.40	1.0000	2.4100	1.0500	0.8700	0.1250	2.000	0.1000	2.000	2	2	5
1675	24.80	100.0000	1.0000	50.0	20.40	1.0000	2.4100	1.0500	0.8700	0.1250	2.000	0.1000	2.000	2	2	5
1676	17.33	76.0000	1.0000	70.0	20.40	1.0000	2.4100	1.0500	0.8700	0.1250	2.000	0.1000	2.000	2	2	5
1677	175.10	40.1000	1.0000	70.0	20.40	2.4100	1.0000	0.8700	1.0500	0.1250	2.000	0.2300	2.000	2	1	1
1678	36.20	159.0000	1.0000	30.0	20.40	1.0000	2.4100	1.0500	0.8700	0.1250	2.000	0.1000	2.000	2	2	5
1679	21.55	94.5000	1.0000	50.0	20.40	1.0000	2.4100	1.0500	0.8700	0.1250	2.000	0.1000	2.000	2	2	5
1680	16.10	70.6000	1.0000	70.0	20.40	1.0000	2.4100	1.0500	0.8700	0.1250	2.000	0.1000	2.000	2	2	5
1681	12.03	60.1700	1.0000	25.0	15.10	2.6000	1.0300	0.8700	1.0100	0.1250	2.000	0.2300	2.000	1	1	1
1682	12.03	60.1700	1.0000	35.0	15.10	2.6000	1.0300	0.8700	1.0100	0.1250	2.000	0.2300	2.000	1	1	1
1683	6.69	33.4100	1.0000	50.0	15.10	2.6000	1.0300	0.8700	1.0100	0.1250	2.000	0.2300	2.000	1	1	1
1684	2.90	14.4800	1.0000	70.0	15.10	2.6000	1.0300	0.8700	1.0100	0.1250	2.000	0.2300	2.000	1	1	1
1685	49.00	9.8000	1.0000	35.0	15.10	2.6000	1.0300	0.8700	1.0100	0.1250	2.000	0.1000	2.000	1	2	5
1686	31.34	6.4600	1.0000	50.0	15.10	2.6000	1.0300	0.8700	1.0100	0.1250	2.000	0.1000	2.000	1	2	5
1687	14.48	72.4200	1.0000	25.0	15.10	2.6000	1.0300	0.8700	1.0100	0.1250	2.000	0.2300	2.000	1	1	1
1688	12.48	62.4100	1.0000	35.0	15.10	2.6000	1.0300	0.8700	1.0100	0.1250	2.000	0.2300	2.000	1	1	1
1689	8.92	44.5800	1.0000	50.0	15.10	2.6000	1.0300	0.8700	1.0100	0.1250	2.000	0.2300	2.000	1	1	1
1690	53.91	10.7900	1.0000	35.0	15.10	1.0300	2.6000	1.0100	0.8700	0.1250	2.000	0.1000	2.000	1	2	5
1691	16.70	33.4000	1.0000	35.0	1.00	1.2800	1.4000	0.8500	1.0900	0.1250	2.000	0.2300	2.000	1	1	1
1692	12.03	24.0700	1.0000	50.0	1.00	1.2800	1.4000	0.8500	1.0900	0.1250	2.000	0.2300	2.000	1	1	1
1693	35.90	10.9000	1.0000	35.0	1.00	1.4000	1.2800	1.0900	0.8500	0.1250	2.000	0.1000	2.000	1	2	5
1694	29.80	9.0000	1.0000	50.0	1.00	1.4000	1.2800	1.0900	0.8500	0.1250	2.000	0.1000	2.000	1	2	5
1695	46.80	69.9000	1.0000	35.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.2300	2.000	2	2	5
1696	28.60	42.7000	1.0000	50.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.2300	2.000	2	2	5
1697	46.80	69.9000	1.0000	35.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.2300	2.000	2	2	5
1698	36.40	54.3000	1.0000	50.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.2300	2.000	2	2	5
1699	29.90	44.7000	1.0000	35.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.1000	2.000	2	2	5
1700	18.70	28.0000	1.0000	50.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.1000	2.000	2	2	5
1701	100.00	55.3000	1.0000	25.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.1000	2.000	1	1	6
1702	72.10	39.7000	1.0000	35.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.1000	2.000	1	1	6
1703	51.50	28.4000	1.0000	50.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.1000	2.000	1	1	6
1704	141.00	63.6000	1.0000	35.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.2300	2.000	2	2	5
1705	80.90	36.6000	1.0000	50.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.2300	2.000	2	2	5
1706	107.00	48.3000	1.0000	35.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.1000	2.000	2	2	5
1707	72.70	32.9000	1.0000	50.0	10.50	1.1200	1.6300	1.0600	0.8140	0.1250	2.000	0.1000	2.000	2	2	5

Table A-3 (continued)

Point No.	V _C	V _D	A	F	Y	μ _D	μ _C	ρ _D	ρ _C	d	D	ε	S	Tr*	CP*	Ct*
	(ft/hr)	(ft/hr)	(in.)	(cycles/min)	(dynes/cm)	(centipoises)		(gm/cm ³)		(in.)	(in.)		(in.)			
1708	118.00	64.9000	1.0000	25.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.1000	2.000	1	1	5
1709	103.00	53.1000	1.0000	35.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.1000	2.000	1	1	5
1710	47.30	26.1000	1.0000	50.0	10.50	1.6300	1.0000	0.8140	1.0000	0.1250	2.000	0.1000	2.000	1	1	5
1711	67.00	111.9000	1.0000	35.0	23.00	0.8700	4.2000	0.8650	1.4200	0.1250	2.000	0.2300	2.000	2	1	1
1712	45.50	76.0000	1.0000	50.0	23.00	0.8700	4.2000	0.8650	1.4200	0.1250	2.000	0.2300	2.000	2	1	1
1713	35.00	58.5000	1.0000	70.0	23.00	0.8700	4.2000	0.8650	1.4200	0.1250	2.000	0.2300	2.000	2	1	1
1714	24.50	40.9000	1.0000	90.0	23.00	0.8700	4.2000	0.8650	1.4200	0.1250	2.000	0.2300	2.000	2	1	1
1715	54.40	77.9000	1.0000	50.0	23.00	0.8700	4.2000	0.8650	1.4200	0.1250	2.000	0.2300	2.000	2	1	1
1716	16.20	82.4100	1.0000	35.0	23.90	0.8700	0.9200	0.8650	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1717	10.90	54.5900	1.0000	50.0	23.90	0.8700	0.9200	0.8650	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1718	8.40	42.4100	1.0000	70.0	23.90	0.8700	0.9200	0.8650	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1719	22.90	92.0000	1.0000	35.0	23.90	0.8700	0.9200	0.8650	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1720	14.10	56.4000	1.0000	50.0	23.90	0.8700	0.9200	0.8650	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1721	10.70	42.8000	1.0000	70.0	23.90	0.8700	0.9200	0.8650	1.0000	0.1250	2.000	0.2300	2.000	1	1	1
1722	9.10	0.8280	0.0950	3.0	10.70	0.6050	0.9260	0.8020	0.9940	0.0400	1.000	0.2300	1.500	4	1	1