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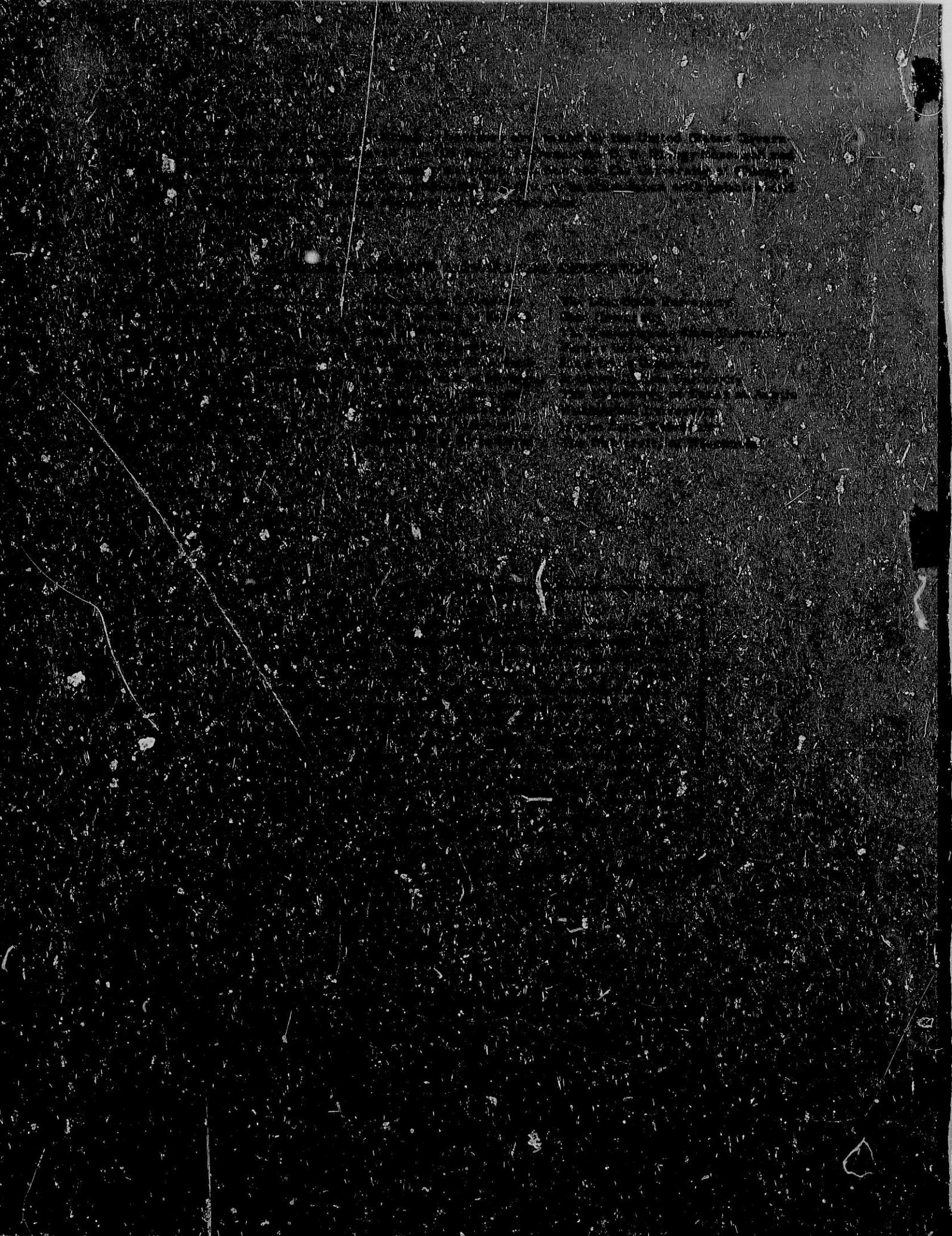
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ISOTOPE ENRICHMENT ISOTOPIC SEPARATION
ANALYSIS

by

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MULTICOMPONENT ISOTOPIC SEPARATION
AND RECIRCULATION ANALYSIS

by

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Chemical Engineering Division

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NOMENCLATURE

$a_{j,i}$	Coefficients of linear equation
$b_{j,i}$	Constants of the linear equation
A	NP x NP coefficient matrix
$a_{i,j}$	Members of matrix A
B	NP x 1 column matrix
$c_{1,i}, c_{2,i} \dots c_{n,i}$	Polynomial fit coefficients
D_1, D_2	Distillate and side stream flow rates
F_1, F_2, F_3	Feed rates
i, 1	Component designation
j, J	Equilibrium stage or plate number
k_i	Equilibrium constant for component i between the liquid and vapor phases
L	Liquid flow rate
L/D	Reflux ratio
n	Degree of polynomial
NP	Number of theoretical stages, or plates
NF_1, NF_2, NF_3	Feed plate numbers
NC	Number of components in the feed mixture
NS	Side stream plate number
P_i	Vapor pressure of component i
P	Total pressure in system
Q_C, Q_B	Heat flow rates for the total condenser and reboiler, respectively
T_j	Temperature of liquid mixture on plate j
V	Vapor flow rate
W	Bottom product removal rate
X	NP x 1 solution matrix
$x_{j,i}$	Mole fraction of component i in liquid phase on plate j
$y_{j,i}$	Mole fraction of component i in vapor phase on plate j
α	Relative volatility

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ABSTRACT

A digital computer program for design of multicomponent distillation columns has been developed based on an exact method of solution of the governing equations. Although this computer program was developed for enrichment of the spent fuels from presently conceived tokamak-type fusion power reactors by cryogenic distillation, the program can be used for the design of any multicomponent distillation column, provided, of course, the necessary thermodynamic and phase equilibrium data are available. To prove the versatility of the computer program, parametric investigations to study the effect of design and operating variables on the composition of the product streams was carried out for the case of separating hydrogen isotopes. The computer program is very efficient; hence, a number of parametric investigations can be carried out with limited resources. The program does, however, require a fairly large computer storage space (approximately 250 K bytes).

I. INTRODUCTION

The estimated fuel (equimolar mixture of deuterium and tritium) burnup rate during a typical fueling cycle for presently-conceived tokamak-type fusion reactors is of the order of a few percent of the injected species; hence, based on economic considerations alone, it is essential that the spent fuel mixture be recycled. However, the contaminants produced in the plasma chamber (by sputtering, transmutation, permeation, chemical reaction, etc.) must be removed from the spent fuel mixture before the fuel can be rejected. While removal of the high molecular weight contaminant atoms appears to present no serious problem, the purification of the hydrogen isotopes (H_2 , HD, HT, D_2 , DT and T_2) into reinjectable forms is a more formidable task. Not only must the protium atoms be removed from the fuel "ash", but the tritium and deuterium atom fractions must be properly adjusted for both cold fuel and neutral beam reinjection. Of the several separation schemes that are under consideration, separation, or more properly enrichment, by cryogenic distillation appears to be most promising. An examination of (1) the composition of the spent gases and (2) the required purity and composition of the injected gases shows that a very complex separation scheme involving many distillation columns, arranged in cascade, would be needed. Before a complex enrichment scheme can be conceived and analyzed, the basic mathematical tools must be developed. The mathematical formulation of analysis of equilibrium stage processes and the solution of the resultant equations using the IBM System 370/195 is described herein.

Distillation is one of the oldest and most widely studied unit operations in the chemical process industries. As a result, numerous books, articles,

and nomographs have been published dealing with the simplest of distillation operations from flash distillation of binary liquids to the most complex industrial distillation practices involving liquid mixtures with many components. Since the recycling of the spent fuels from a D-T burning fusion power reactor will require a unique separation scheme, an exhaustive study of the literature on distillation practices would be of limited value. Similarly, for the separation of the isotopes of hydrogen, a fundamental study of the heat and mass transfer processes that occur within a distillation column and the hydrodynamic behavior of such columns would be beyond the scope of the present undertaking. Hence, the survey of the literature was limited to a few references describing the basic equilibrium stage processes (Refs. 1-5) and experimental investigation of some of those systems that involve isotopes of hydrogen (Refs. 6-9).

II. DEVELOPMENT OF COMPUTER PROGRAM

There are several analytical techniques^{1,2,3} used in design of multi-component distillation columns. While most of these methods are adequate to fulfill the needs of the chemical process industries, only the exact method of solution by matrix algorithm appears suitable for isotope separation. The inaccuracies inherent in empirical schemes and trial-and-error solutions make these methods entirely unsuitable for achieving the level of accuracy required in plasma fuels analysis. Hence, at the outset, it was decided to proceed with analyses based on an exact method of solution of the governing questions. This should ensure that the accuracy of the analytical results will be limited only by the accuracy of the thermodynamic and phase equilibrium data.

A. General Considerations of Multicomponent Distillation

A complex distillation column may be comprised of many feeds, side streams, and other special features. The feed compositions may vary widely and may be introduced at any stage (or plate). Development of the computer simulation for a single distillation column was based on the general features shown in Fig. 1. Once the basic computer program that contained the essential characteristics of a single column was developed, other special features were added by appropriately modifying the mathematical model. Several simplifying assumptions, of necessity, were made before the development of the mathematical model was carried out. The ideal equilibrium stage concept in conjunction with the laws of conservation of mass and energy may be utilized to describe the functional relations among the various components. These assumptions may be stated briefly as follows:

- (1) The pressure drop across the column is negligible so that the column may be assumed to operate at a constant pressure.
- (2) Heat losses are small so that each column may be assumed to operate adiabatically.
- (3) The molar heats of vaporization of all components are the same so that constant molar vapor flow may be assumed. (This is not a very restrictive assumption because the differences in the molar heats of vaporization of the six isotopic species of hydrogen are small.)

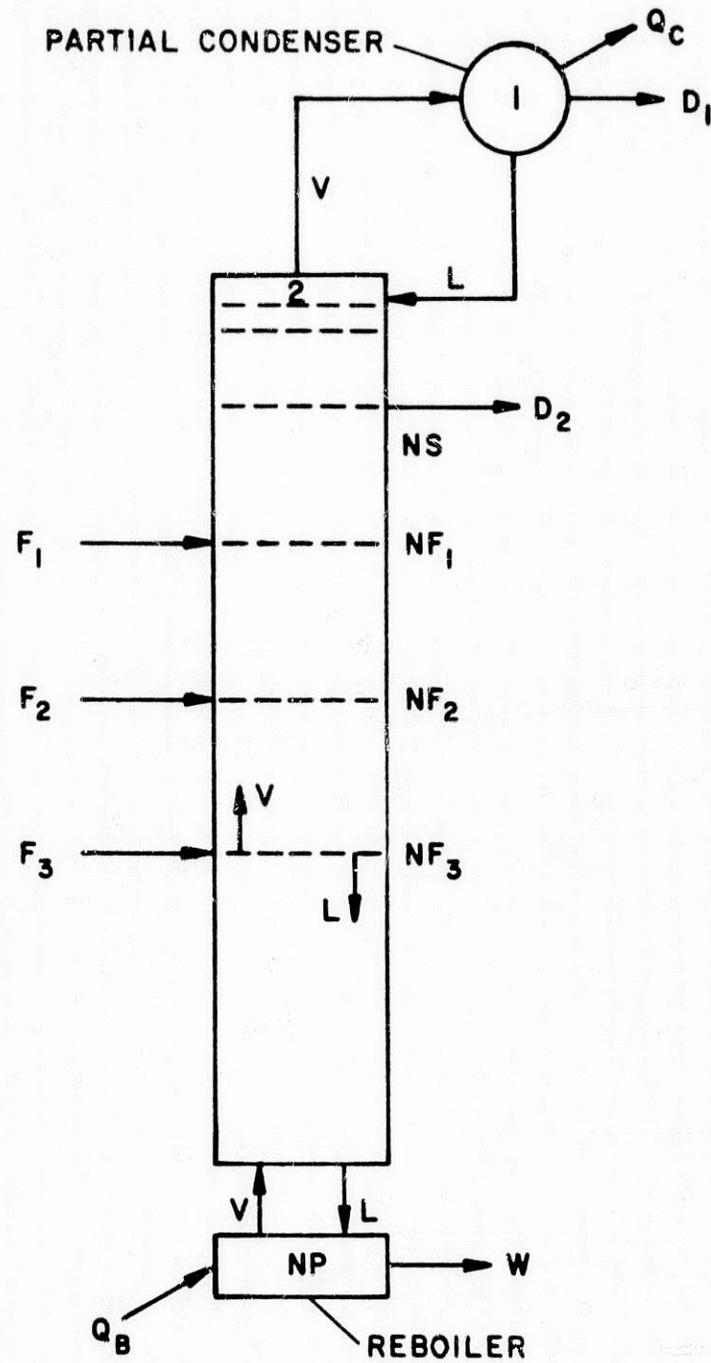


Fig. 1. Complex Distillation Column - Schematic

- (4) The vapors and liquids of the isotopes form ideal mixtures. (This is not an unrealistic assumption for isotopes of the same element, especially at low pressures.)

Assumption (4) assures the validity of the laws of Raoult and Dalton; thus, the equilibrium relationship between the vapor mole fraction and liquid mole fraction may be represented by:

$$y_i = k_i x_i \quad (1)$$

$$k_i = \frac{p_i}{P} \quad (2)$$

where

y_i = mole fraction of component i in vapor phase

x_i = mole fraction of component i in liquid phase

k_i = equilibrium constant for component i between the two phases

p_i = partial pressure of component i

P = total pressure of the system

B. Mathematical Formulation

The composition of the feeds and the rates of the feeds, the distillates, and the side streams are assumed to be known. For a given number of equilibrium stages (NP), assumed feedplate and side stream locations (NF₁, NF₂, NS) and reflux ratio (L/D), the functional relationship between the various components across the distillation column may be expressed mathematically as follows. For component i (there are assumed to be NC components), the law of conservation of mass and phase equilibrium leads to NP (NP = number of theoretical stages) equations, each containing NP terms. By denoting the phase number as j and component number as i , the following set of NP equations may be written:

$$-a_{1,1} x_{1,i} + a_{1,2} x_{2,i} + 0 + 0 + \dots = b_{1,1} \quad (3-1)$$

$$a_{2,1} x_{1,i} - a_{2,2} x_{2,i} + a_{2,3} x_{3,i} + 0 + \dots = b_{2,1} \quad (3-2)$$

$$0 + a_{3,2} x_{2,i} - a_{3,3} x_{3,i} + a_{3,4} x_{4,i} + 0 \quad (3-3)$$

⋮

$$+ \dots = b_{3,1}$$

$$0 + 0 + \dots + a_{NP,NP-1} x_{NP-1,i} - a_{NP,NP} x_{NP,i} = b_{NP,1} \quad (3-NP)$$

The above set of NP equations may be expressed in matrix algebra as follows:

$$AX = B \quad (4)$$

where

A = NP x NP square matrix

X = NP x 1 column matrix

B = NP x 1 column matrix

The nature of the physical problem is such that it leads directly to a tri-diagonal matrix as represented by Equations (3-1), (3-2) ... (3-NP). It should be noted that there are NC sets of independent equations (one for each component) of the type represented by matrix Equation (4). For a physical problem, since the determinant of the NP x NP square matrix is non-singular, the solution of Equation (4) is given by

$$X = A^{-1}B \quad (5)$$

where A^{-1} is the inverse of matrix A. Hence, the solution of Equation (4) results in NP values of component i, one value corresponding to each equilibrium stage. Similarly, the solution of the remaining sets of equations of type (4) gives the mole fractions of the other components in the liquid mixture. Thus, we have the mole fractions of all components at each equilibrium stage.

C. Convergence Criteria

The correct solution is obtained when the following criterion is satisfied (with an acceptable degree of tolerance) simultaneously at each stage.

$$\sum_1^{NC} y_i = 1 = \sum_1^{NC} k_i x_i$$

From this brief discussion, it is apparent that successful solution of the above set of equations depends on development of reliable convergence criteria. For ideal mixtures, the equilibrium constant, k, may be represented as a function of pressure and temperature. Since the column is assumed to operate at a constant pressure, the equilibrium constant is dependent on temperature only. Existing vapor pressure data (Ref. 10) for the six hydrogen isotopes were used to calculate the equilibrium constants. For a typical spent gas mixture, existing vapor pressure data for the range from 20 to 30°K were found to be adequate to cover the entire range of interest. For component i, k_i may be represented by an n^{th} degree polynomial:

$$k_i = C_{1,i} + C_{2,i}T_j + C_{3,i}T_j^2 + \dots + C_{n,i}T_j^n \quad (7)$$

where $C_{1,x}$, $C_{2,i}$, etc., are constants, and T_j is the temperature of the liquid mixture at plate j. Since the operating temperature range for the column over the pressure range from 500 to 2500 Torr is quite limited, a fourth degree polynomial was found to adequately represent the data. A subroutine was written to obtain the polynomial fitting coefficients for each component by a least squares method.

Before proceeding with the calculations, the end temperatures of the column were assumed, guided by the saturation temperature corresponding to

the composition of the feed mixture. Additionally, the temperature drop across the column was assumed to be a linear function of the number of theoretical stages so that a set of starting values of the equilibrium constants could be estimated. To accelerate the convergence, Newton-Raphson interpolation techniques were applied to estimate a set of new temperatures for each plate during the successive iterative steps.

The solution of a set of linear equations for a typical component involves very large numbers. For example, the determinant of a 30 x 30 square matrix for most of the hydrogen isotopes represented by Equation (4) is of the order of 10^{33} . To reduce the round-off errors, the main program as well as all of the subroutines were written in double precision. Thus, the propagation of round-off errors that is inherent in conventional iterative solutions is minimized. In order to ascertain the validity of the matrix inversion method adopted in solving Equation (4), the solution vectors were back substituted to see whether the original constant vectors would be obtained. For all the cases considered, no error in the computational techniques could be found.

III. DESCRIPTION OF COMPUTER CODE

The Multicomponent Isotopic Separation and Recirculation Analysis (MISRA) computer code calculates the composition of the liquid at each theoretical plate based on a given set of data for (1) feed composition, (2) number of theoretical plates, (3) reflux ratio, (4) number of feeds and their respective locations, (5) side stream withdrawal location, (6) operating pressure, and (7) the flow rates of the feed, distillate, side stream and the bottom product. The computer program consists of the following subprograms:

MCDIST. This subroutine sets up the governing equations based on the law of conservation of mass and phase equilibria, and then solves the resultant set of linear equations by matrix inversion. The solution vectors are the composition of the liquid at each equilibrium stage. ANL library subroutine MTINV (matrix inversion) is required in solving the equations.

POLYFT. Based on a set of temperature vapor pressure data, and assuming formation of ideal solutions (both in liquid and vapor phases), POLYFT computes by least-square fit the coefficients of a fourth degree polynomial to express the phase equilibrium constants as a function of temperature. It needs ANL library subroutine MINFIT (a least squares analysis package).

Fortran listings of the main program and the subroutines are given in the Appendix.

A. Description of INPUT Data

<u>Card No.</u>	<u>FORTRAN Name</u>	<u>Format</u>	<u>Description</u>
1	TITLE	9A8	A set of alpha-numeric information to identify the input data.
2	NP	11I6	Order of matrix $Ax = B$. Number of theoretical stages or plates ($NP \leq 50$).
	M		Order of column reader B. Also, used to terminate program calculations by input control ($M \leq 2$). $M \leq 0$ terminates calculation.
	INPUT		Integer constant used to signal whether or not to printout the input data. $INPUT \leq 0$ skips input data printing.
	NF ₁ NF ₂ NF ₃		Feed plate locations, where feeds F_1 , F_2 and F_3 are introduced.
	NC NS		Number of components in the feed ($NC \leq 6$). Side stream withdrawal location.
	NTRL		Number interactions before calculations are terminated.
	NR		Integer constant used to control printing of intermediate calculations, $NR \leq 0$ prints the summary of calculations at the end of each iteration. $NR \geq 1$, prints only the final calculations.
	IPRNT		Constant used to signal whether to print the coefficients and constants of the linear equations corresponding to each plate. $IPRNT < 0$ prints the coefficient for component $i = 1$ and the solution vectors for all components during the first iteration only.
3	NM1	11I6	Order of matrix $Ax = B$, ($NM1 \leq 20$).
	M1		Number of rows of vector B ($M1 \leq 20$).
	IP		Number of columns of vector B ($IP \leq 2$).
	N ₁		Number of temperature/vapor pressure data points.
	NP ₁		Number of temperature/vapor pressure data points.

<u>Card No.</u>	<u>FORTTRAN Name</u>	<u>Format</u>	<u>Description</u>
	NPR		Integer constant having values 1 to 5, and is designed to select the NPR th pressure to calculate the equilibrium constants.
	KOEF		This constant signals whether to read the vapor pressure/temperature data or the fitting coefficients. KOEF \geq 1 read the coefficient. NOTE: either temperature/vapor pressure data or the equilibrium coefficients should be included in the input, but not both.
4-5	D ₁ , D ₂	6D12.6/ 3D12.6	Distillate and side stream flow rate.
	F ₁ , F ₂ , F ₃		Rates of feed. NOTE: it is not necessary to have all three feeds. If only one feed is used, it should be designated as F ₃ . If two feeds are used, they should be designated as F ₂ and F ₃ . Of course, one has to select the proper feed plate location depending on the number and the composition of the feeds.
	T _B , T _D		Temperature of the column corresponding to the bottom and top plates. These temperatures are used to guess a set of starting temperatures for computing the liquid composition.
	VO		Vapor flow rate.
	W		Bottom product flow rate.
6	PT	6D12.6	A set of operating pressures.
7	XF1	6D12.6	Composition of F ₁ .
8	XF2	6D12.6	Composition of F ₂ .
9	XF3	6D12.6	Composition of F ₃ .
<u>IF KOEF \geq 1</u>			
10-11	C ₁ -C ₆	4D18.6/ 1D18.6	Value of fitting coefficients for H ₂ .
12-13	C ₁ -C ₆	4D18.6/ 1D18.6	Value of fitting coefficients for HD.
14-15	C ₁ -C ₆	4D18.6/ 1D18.6	Value of fitting coefficients for HT.
16-17	C ₁ -C ₆	4D18.6/ 1D18.6	Value of fitting coefficients for D ₂ .
18-19	C ₁ -C ₆	4D18.6/ 1D18.6	Value of fitting coefficients for DT.
20-21	C ₁ -C ₆	4D18.6/ 1D18.6	Value of fitting coefficients for T ₂ .

<u>Card No.</u>	<u>FORTRAN Name</u>	<u>Format</u>	<u>Description</u>
<u>IF KOEF \leq 0</u>			
10-13	VT	6D12.6	A set of saturation temperatures.
14-17	VP	"	Vapor pressure data corresponding to the above set of temperatures for H ₂ .
18-21		"	Vapor pressure data corresponding to the above set of temperatures for HD.
22-25		"	Vapor pressure data corresponding to the above set of temperatures for HT.
26-29		"	Vapor pressure data corresponding to the above set of temperatures for D ₂ .
30-33		"	Vapor pressure data corresponding to the above set of temperatures for DT.
34-37		"	Vapor pressure data corresponding to the above set of temperatures for T ₂ .
38			Blank Card (<i>i.e.</i> , M \leq 0) terminates the program calculations.

B. Program Limitations

The current structure of the DIMENSION statements limit the program to the following:

NP (\leq 50)	Number of theoretical plats
NC, NC ₁ (\leq 6)	Number of components
NPR (\leq 5)	Number of operating pressures
NP ₁ (\leq 20)	Temperature/vapor pressure data points

Since the above limits are not the inherent limitations on the mathematical formulations, one can easily broaden the program to accept a larger input variable. However, the stability of the code, and the convergence criteria must be checked to ensure that the computed results are consistent with the physical system. The other limitations are: three feeds, one side stream product in addition to one top product (distillate), and one bottom product.

C. INPUT Data for a Sample Problem

Of the number of steps involved in designing a distillation column, the estimation of the number of theoretical stages or plates is the most important and fundamental step. For a given feed mixture and the desired product purity, the simplest design procedure from the computational stand-point is to carry out a parameteric investigation of the effects of the number of

theoretical stages, reflux ratio, feed plate location and operating pressure, and then select a set of the desired operating conditions that closely matches the composition of the product required. The input constants for a column consisting of 30 theoretical stages and operating at 1000 Torr are listed in Table 1. A summary of the calculations are shown in Table 2. The versatility of the computer code may be demonstrated by the parametric investigation of a number of cases as summarized below.

IV. DISCUSSION OF ANALYTICAL RESULTS

In order to study how enrichment of the spent fuel proceeds across a distillation column, a number of cases with only a single feed and no side stream draw off, for simplicity, were analyzed. The composition of the feed (spent fuel) was assumed to be representative of presently conceived tokamak-type reactors such as the ANL Experimental Power Reactor (ANL/EPR).¹¹ Several cases were analyzed by varying the number of theoretical stages, reflux ratio, feed plate location and operating pressure firstly, to study the behavior of distillation columns handling isotopes of hydrogen, and secondly, to detect any anomalous behavior of the computer code such as lack of convergence. These results are summarized (in the form of computer print outs) in Tables 3-18.

All of the pertinent operating characteristics of the column, the composition of the feed, temperature of the liquid at each equilibrium stage, and summation of the liquid composition at each equilibrium stage are listed in the tables. In addition, the tables show the composition of the six isotopes of hydrogen and the atom percentage of the three species of hydrogen. Since the distillation column has been assumed to contain a partial condenser, the composition of the vapor leaving the column as distillate and the composition of the liquid returning to the column as reflux are shown under Plate No. 1. An examination of the plate temperatures show that, for most cases, the difference between the bottom plate temperature and the top plate temperature is less than 1 K. Summation of the liquid mole fractions approaches 1 after 10 iterations, although the tables show computed values after 15 iterations. The following observations may be made from the summary of the computer results.

A. Effect of Number of Theoretical Stages

As the number of the theoretical stages are increased, separation of the lighter fractions from the heavier fractions is enhanced (see Tables 3-6). For example, if the number of theoretical stages is increased from 15 to 30, the deuterium atom concentration in distillate is increased from 75 to 83%. However, the atom percentage of protium remains unchanged. This is due to the fact that essentially all of protium appears in the distillate even when the column has only 15 theoretical stages.

B. Effect of Reflux Ratio

The degree of separation of the lighter constituents from the heavier constituents increases as the reflux ratio is increased (see Tables 7 to 11). However, the increase in the degree of separation becomes asymptotic, as higher and higher reflux ratios are employed.

C. Effect of Feed Plate Location

The effect of the feed plate on degree of separation depends on the feed composition. For the few cases analyzed by varying the feed plate location for a feed of fixed composition, the effect of the feed plate location was found to be minor.

D. Effect of Operating Pressure

As discussed in the previous sections, for a fixed feed composition, the separation of the more volatile fractions depends on the number of theoretical stages, reflux ratio, and the design characteristics of the distillation column. As the number of theoretical stages and reflux ratio are increased, the degree of separation of the more volatile fraction from the less volatile fraction increases. In many situations, the effects of these two variables do not significantly change the degree of separation. Also, increase in number of equilibrium stages as well as increase in reflux ratio results in increased liquid holdup and operating cost. However, similar results can be achieved by varying the operating pressure, which is conceptually much simpler.

For ideal solutions, the equilibrium constant, k_i , can be expressed as

$$k_i = \frac{y_i}{x_i} \quad (8)$$

$$= \frac{p_i}{p} \quad (9)$$

where

- k_i = equilibrium constant for component i
- y_i = mole fraction of component i in vapor phase
- x_i = mole fraction of component i in liquid phase
- p_i = vapor pressure of component i
- p = total operating pressure of the system

The relative volatility of component 1 with response to component 2 can be expressed by

$$a_{1,2} = \frac{k_1}{k_2} = \frac{p_1}{p_2} \quad (10)$$

Hence, for ideal mixtures, the relative volatility is independent of pressure, provided, of course, that the column is operated at the same temperature. As the column will be operated at the saturation temperature corresponding to the composition of the liquid mixture at each equilibrium stage, the degree of separation can be controlled to some extent by the operating pressure.

In order to study the effect of pressure, a column with one feed was used for simplicity. The results for a typical feed mixture at pressures of 500, 1000, 1500, 2000, and 2500 Torr, respectively, are summarized in Tables 12-16. The most significant effect of pressure seems to be on the atom fraction of tritium in the distillate. The tritium fraction increases from 7 to 15% when the pressure is increased from 500 to 2500 Torr. The pressure has lesser effect on the other two hydrogen isotopes. Since the atom percent of hydrogen in the bottom fraction is essentially zero, for all cases, the operating pressure should have no effect on protium fraction. The atom fraction of deuterium in the distillate decreases from 86 to 78% as the pressure is increased from 500 to 2500 Torr.

To further demonstrate the general utility of the computer code, two other cases consisting of 30 and 50 theoretical stages, respectively, and each with three feeds were analyzed. The analytical results are shown in Tables 17 and 18.

V. CONCLUSIONS

A mathematical simulation of multicomponent distillation was developed and computer solution of the resultant equations was carried out. Since the computational steps are based on an exact solution method, the accuracy of the analytical results is expected to be limited only by the accuracy of the thermodynamic and phase equilibrium data. Although the computer code was developed specifically for enrichment of the spent fuels from presently conceived tokamak-type fusion reactors, the scope of this program is much broader, in that it can be used in the design and analysis of multicomponent distillation for any liquid mixture, provided, of course, the necessary thermodynamic and phase equilibrium data are available. The program is very efficient so that a number of parametric investigations to study the effects of design and operating variables can be carried out even with limited financial resources. The program does, however, require a fairly large computer storage (approximately 250 K bytes). In general, the results generated by this program are in good agreement with those of similar studies carried out by Wilkes.¹²

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Table 1. INPUT Data for Sample Problem

15	1	1	5	6	7	6	6	10	2	0
20	20	5	1	20	6	5	0	2	0	
3.000000D 01		0.0			0.0			0.0		1.000000D 02
2.450000D 01		4.800000D 02			7.000000D 01					2.650000D 01
4.500000D 02		1.000000D 03			1.500000D 03		2.000000D 03		2.500000D 03	

FEED COMPOSITION

1.000000D-04	5.000000D-03	5.000000D-03	2.500000D-01	4.899000D-01	2.500000D-01
8.000000D-03	3.198990D-02	3.194160D-02	9.207500D-01	7.326180D-03	6.510520D-08
2.000000D-03	2.700000D-02	1.100000D-02	2.620000D-01	4.280000D-01	2.700000D-01

TEMPERATURE/VAPOR PRESSURE DATA

2.000000D 01	6.774000D 02	3.827000D 02	2.888000D 02	2.206000D 02	1.649000D 02	1.187000D 02
2.050000D 01	7.857000D 02	4.547000D 02	3.472000D 02	2.676000D 02	2.028000D 02	1.537000D 02
2.100000D 01	9.057000D 02	5.355000D 02	4.139000D 02	3.218000D 02	2.469000D 02	1.895000D 02
2.150000D 01	1.038300D 03	6.277000D 02	4.898000D 02	3.836000D 02	2.980000D 02	2.314000D 02
2.200000D 01	1.184000D 03	7.287000D 02	5.753000D 02	4.542000D 02	3.566000D 02	2.800000D 02
2.250000D 01	1.343700D 03	8.423000D 02	6.712000D 02	5.338000D 02	4.235000D 02	3.360000D 02
2.300000D 01	1.517900D 03	9.680000D 02	7.782000D 02	6.233000D 02	4.993000D 02	4.000000D 02
2.350000D 01	1.707300D 03	1.106800D 03	8.972000D 02	7.232000D 02	5.848000D 02	4.727000D 02
2.400000D 01	1.912800D 03	1.259200D 03	1.028700D 03	8.345000D 02	6.806000D 02	5.548000D 02
2.450000D 01	2.135100D 03	1.426100D 03	1.173600D 03	9.577000D 02	7.875000D 02	6.471000D 02
2.500000D 01	2.374900D 03	1.608300D 03	1.332600D 03	1.093500D 03	9.062000D 02	7.503000D 02
2.550000D 01	2.632900D 03	1.806500D 03	1.506400D 03	1.249900D 03	1.037400D 03	8.652000D 02
2.600000D 01	2.910000D 03	2.012400D 03	1.695800D 03	1.406400D 03	1.181900D 03	9.923000D 02
2.650000D 01	3.207000D 03	2.254000D 03	1.901600D 03	1.584900D 03	1.340700D 03	1.132700D 03
2.700000D 01	3.524600D 03	2.504900D 03	2.124500D 03	1.779100D 03	1.514200D 03	1.286900D 03
2.750000D 01	3.863800D 03	2.775100D 03	2.365400D 03	1.989800D 03	1.703500D 03	1.455900D 03
2.800000D 01	4.225300D 03	3.065500D 03	2.625100D 03	2.217900D 03	1.909200D 03	1.640300D 03
2.850000D 01	4.610200D 03	3.376700D 03	2.901100D 03	2.464000D 03	2.132200D 03	1.841100D 03
2.900000D 01	5.019200D 03	3.710000D 03	3.203900D 03	2.729100D 03	2.373300D 03	2.058900D 03
2.950000D 01	5.453500D 03	4.065900D 03	3.524600D 03	3.013900D 03	2.633500D 03	2.294600D 03

POLYNOMIAL FITTING COEFFS. FOR EQLBM. CONSTANTS AT PT= 1000.D 00 TORR

7.659677D-01	-6.033137D-02	-4.640048D-04	-5.739917D-05	1.101835D-05
-3.348612D 00	5.975073D-01	-3.747318D-02	7.909861D-04	2.763535D-06
-8.368202D-01	1.927116D-01	-1.259054D-02	1.058304D-04	9.132107D-06
6.550951D-01	-7.090902D-02	5.194761D-03	-4.188036D-04	1.410413D-05
-2.210739D 00	3.766744D-01	-2.012363D-02	2.002574D-04	8.059631D-06
-6.398138D 00	1.030710D 00	-5.778316D-02	1.156992D-03	-1.492615D-06

Table 2. Summary of Calculations for Sample Problem

ISOTOPIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 10
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND FP LOCATION= 12 3RD FP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
2.000000D-03	2.700000D-02	1.100000D-02	2.620000D-01	4.280000D-01	2.700000D-01	2.100D 00	4.895D 01	4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K..(FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)

2.463940D 01	2.471113D 01	2.476722D 01	2.481384D 01	2.485480D 01	2.489245D 01
2.492820D 01	2.496291D 01	2.499708D 01	2.503102D 01	2.506492D 01	2.509890D 01
2.513306D 01	2.516744D 01	2.520210D 01	2.522236D 01	2.524089D 01	2.525856D 01
2.527597D 01	2.529356D 01	2.531168D 01	2.533062D 01	2.535069D 01	2.537221D 01
2.539553D 01	2.542105D 01	2.544922D 01	2.548052D 01	2.551541D 01	2.555433D 01

SUMMATION OF LIQUID MOLE FRACTIONS.....(FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)

1.000194D 00	1.000196D 00	1.000201D 00	1.000206D 00	1.000211D 00	1.000214D 00
1.000215D 00	1.000213D 00	1.000208D 00	1.000200D 00	1.000189D 00	1.000176D 00
1.000160D 00	1.000143D 00	1.000124D 00	1.000130D 00	1.000135D 00	1.000139D 00
1.000141D 00	1.000143D 00	1.000144D 00	1.000143D 00	1.000141D 00	1.000138D 00
1.000134D 00	1.000128D 00	1.000121D 00	1.000113D 00	1.000104D 00	1.000093D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.655694D-03	8.982618D-02	3.636633D-02	7.100407D-01	1.535170D-01	3.787683D-03	6.975D 00	8.317D 01	9.873D 00
1	3.024611D-03	6.092038D-02	2.988474D-02	7.132294D-01	1.873273D-01	5.613532D-03	4.842D 00	8.372D 01	1.142D 01
2	1.455411D-03	4.181880D-02	2.444408D-02	7.027871D-01	2.215148D-01	7.979869D-03	3.458D 00	8.343D 01	1.309D 01
3	7.874924D-04	2.948023D-02	2.004029D-02	6.828941D-01	2.557834D-01	1.101452D-02	2.554D 00	8.254D 01	1.489D 01
4	5.055449D-04	2.162934D-02	1.655927D-02	6.566389D-01	2.897981D-01	1.486889D-02	1.960D 00	8.122D 01	1.630D 01
5	3.864516D-04	1.667847D-02	1.384966D-02	6.262318D-01	3.231371D-01	1.971650D-02	1.565D 00	7.960D 01	1.882D 01
6	3.353301D-04	1.356719D-02	1.176119D-02	5.932844D-01	3.553066D-01	2.575138D-02	1.300D 00	7.776D 01	2.092D 01
7	3.123522D-04	1.160669D-02	1.016062D-02	5.590030D-01	3.857322D-01	3.318506D-02	1.119D 00	7.575D 01	2.311D 01
8	3.009639D-04	1.035823D-02	8.936538D-03	5.243131D-01	4.138493D-01	4.224192D-02	9.946D-01	7.363D 01	2.536D 01
9	2.943378D-04	9.546437D-03	7.999108D-03	4.899342D-01	4.390732D-01	5.315268D-02	9.065D-01	7.141D 01	2.766D 01
10	2.896747D-04	9.000513D-03	7.277592D-03	4.564263D-01	4.608602D-01	6.614567D-02	8.427D-01	6.912D 01	3.002D 01
11	2.858314D-04	8.615628D-03	6.717289D-03	4.242170D-01	4.787284D-01	8.143583D-02	7.951D-01	6.678D 01	3.241D 01
12	2.823414D-04	8.328008D-03	6.276497D-03	3.936208D-01	4.922809D-01	9.921144D-02	7.583D-01	6.438D 01	3.484D 01
13	2.790132D-04	8.099172D-03	5.923809D-03	3.648540D-01	5.012251D-01	1.196188D-01	7.289D-01	6.194D 01	3.731D 01
14	2.757673D-04	7.906080D-03	5.635830D-03	3.380492D-01	5.053871D-01	1.427460D-01	7.046D-01	5.946D 01	3.982D 01
15	2.725704D-04	7.735048D-03	5.395322D-03	3.132685D-01	5.047225D-01	1.686060D-01	6.837D-01	5.694D 01	4.236D 01
16	1.255548D-04	5.233586D-03	4.379295D-03	3.008212D-01	5.179055D-01	1.715349D-01	4.931D-01	5.623D 01	4.326D 01
17	5.761395D-05	3.525552D-03	3.536491D-03	2.871563D-01	5.309192D-01	1.748048D-01	3.588D-01	5.543D 01	4.420D 01
18	2.634147D-05	2.364920D-03	2.841522D-03	2.724837D-01	5.437201D-01	1.785634D-01	2.629D-01	5.455D 01	4.518D 01
19	1.200037D-05	1.579673D-03	2.271355D-03	2.569739D-01	5.561792D-01	1.829839D-01	1.937D-01	5.358D 01	4.621D 01
20	5.447226D-06	1.050559D-03	1.805711D-03	2.407743D-01	5.680869D-01	1.882771D-01	1.433D-01	5.253D 01	4.732D 01
21	2.463393D-06	6.954400D-04	1.427061D-03	2.240197D-01	5.791509D-01	1.947044D-01	1.064D-01	5.139D 01	4.849D 01
22	1.109654D-06	4.580380D-04	1.120443D-03	2.068384D-01	5.899912D-01	2.025908D-01	7.902D-02	5.015D 01	4.976D 01
23	4.977576D-07	2.999692D-04	8.732011D-04	1.893557D-01	5.971333D-01	2.123373D-01	5.870D-02	4.880D 01	5.113D 01
24	2.222540D-07	1.951615D-04	6.747006D-04	1.716969D-01	6.030004D-01	2.244327D-01	4.351D-02	4.732D 01	5.262D 01
25	9.872254D-08	1.259745D-04	5.160598D-04	1.539889D-01	6.059087D-01	2.394603D-01	3.211D-02	4.569D 01	5.426D 01
26	4.357899D-08	8.051764D-05	3.898981D-04	1.363626D-01	6.050686D-01	2.580984D-01	2.352D-02	4.389D 01	5.608D 01
27	1.908232D-08	5.080628D-05	2.901118D-04	1.189544D-01	5.995968D-01	2.811079D-01	1.705D-02	4.187D 01	5.810D 01
28	8.258066D-09	3.149882D-05	2.116748D-04	1.019091D-01	5.885463D-01	3.093014D-01	1.216D-02	3.962D 01	6.036D 01
29	3.503770D-09	1.903544D-05	1.504649D-04	8.538124D-02	5.709607D-01	3.434885D-01	8.474D-03	3.708D 01	6.290D 01
30	1.429832D-09	1.105298D-05	1.031116D-04	6.953593D-02	5.459581D-01	3.843918D-01	5.708D-03	3.425D 01	6.574D 01

Table 3. Effect of Number of Theoretical Stages

ISOTOPIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 15 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 5 2ND PP LOCATION= 6 3RD PP LOCATION= 7
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 0.0 BOTTOMS: 7.00D 01

FEED COMP.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
2.000000D-03	2.700000D-02	1.100000D-02	2.620000D-01	4.280000D-01	2.700000D-01	2.100D 00	4.895D 01	4.895D 01	

EQUILIBRIUM STAGE TEMPERATURES, DEG.X.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)

2.477319D 01	2.487500D 01	2.495381D 01	2.502059D 01	2.508023D 01	2.513521D 01
2.518689D 01	2.521978D 01	2.525210D 01	2.528545D 01	2.532088D 01	2.535924D 01
2.540122D 01	2.544735D 01	2.549799D 01			

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)

1.000000D 00					
1.000000D 00					
1.000000D 00	1.000000D 00	1.000000D 00			

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666650D-03	8.935635D-02	3.473226D-02	5.704631D-01	2.683498D-01	3.043185D-02	6.871D 00	7.493D 01	1.820D 01
1	1.872457D-03	5.868936D-02	2.759073D-02	5.530886D-01	3.154035D-01	4.335529D-02	4.501D 00	7.401D 01	2.149D 01
2	5.992456D-04	3.884902D-02	2.170680D-02	5.230572D-01	3.569591D-01	5.882867D-02	3.088D 00	7.210D 01	2.482D 01
3	2.662392D-04	2.642653D-02	1.709466D-02	4.863351D-01	3.927862D-01	7.709124D-02	2.203D 00	6.959D 01	2.820D 01
4	1.791891D-04	1.880053D-02	1.358423D-02	4.466621D-01	4.224737D-01	9.830028D-02	1.637D 00	6.673D 01	3.163D 01
5	1.556160D-04	1.417278D-02	1.096376D-02	4.065291D-01	4.456580D-01	1.225207D-01	1.272D 00	6.364D 01	3.508D 01
6	1.483106D-04	1.137592D-02	9.033045D-03	3.676089D-01	4.621231D-01	1.497107D-01	1.035D 00	6.044D 01	3.853D 01
7	1.451986D-04	9.677710D-03	7.621953D-03	3.309934D-01	4.718504D-01	1.797113D-01	8.795D-01	5.718D 01	4.194D 01
8	4.322422D-05	6.530006D-03	6.120371D-03	3.109908D-01	4.866273D-01	1.896883D-01	6.368D-01	5.576D 01	4.361D 01
9	1.279560D-05	4.365423D-03	4.859011D-03	2.888100D-01	4.998286D-01	2.021242D-01	4.625D-01	5.409D 01	4.545D 01
10	3.765951D-06	2.888100D-03	3.808834D-03	2.647910D-01	5.107890D-01	2.177192D-01	3.352D-01	5.216D 01	4.750D 01
11	1.101449D-06	1.887250D-03	2.941802D-03	2.392639D-01	5.186347D-01	2.372713D-01	2.416D-01	4.995D 01	4.981D 01
12	3.198421D-07	1.214380D-03	2.232114D-03	2.125808D-01	5.223129D-01	2.616595D-01	1.724D-01	4.743D 01	5.239D 01
13	9.202388D-08	7.657623D-04	1.656631D-03	1.851358D-01	5.206423D-01	2.917994D-01	1.211D-01	4.458D 01	5.529D 01
14	2.608299D-08	4.694496D-04	1.194910D-03	1.573760D-01	5.123954D-01	3.285642D-01	8.322D-02	4.138D 01	5.854D 01
15	7.144257D-09	2.758488D-04	8.290309D-04	1.298015D-01	4.964215D-01	3.726721D-01	5.524D-02	3.782D 01	6.213D 01

Table 4. Effect of Number of Theoretical Stages

ISOTOPIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 20 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 6 2ND PP LOCATION= 8 3RD PP LOCATION= 10
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
2.000000D-03	2.700000D-02	1.100000D-02	2.620000D-01	4.280000D-01	2.700000D-01	2.100D 00	4.895D 01	4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)

2.470881D 01	2.479932D 01	2.486817D 01	2.492601D 01	2.497762D 01	2.502546D 01
2.507095D 01	2.511488D 01	2.515773D 01	2.519971D 01	2.522658D 01	2.525229D 01
2.527822D 01	2.530522D 01	2.533399D 01	2.536512D 01	2.539918D 01	2.543670D 01
2.547813D 01	2.552384D 01				

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)

1.000000D 00					
1.000000D 00					
1.000000D 00					
1.000000D 00					

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666653D-03	8.977237D-02	3.573771D-02	6.311466D-01	2.224230D-01	1.425404D-02	6.942D 00	7.872D 01	1.433D 01
1	1.893866D-03	5.988235D-02	2.885771D-02	6.224724D-01	2.661959D-01	2.069784D-02	4.626D 00	7.855D 01	1.682D 01
2	6.128838D-04	4.030463D-02	2.311224D-02	5.998789D-01	3.073995D-01	2.869192D-02	3.232D 00	7.737D 01	1.939D 01
3	2.737968D-04	2.786282D-02	1.853671D-02	5.690617D-01	3.457646D-01	3.850044D-02	2.347D 00	7.559D 01	2.207D 01
4	1.841127D-04	2.009533D-02	1.499048D-02	5.335829D-01	3.807664D-01	5.038075D-02	1.773D 00	7.340D 01	2.483D 01
5	1.596754D-04	1.529554D-02	1.228955D-02	4.958733D-01	4.119071D-01	6.457486D-02	1.395D 00	7.094D 01	2.766D 01
6	1.521913D-04	1.234027D-02	1.025583D-02	4.576531D-01	4.303036D-01	8.129496D-02	1.145D 00	6.830D 01	3.056D 01
7	1.491199D-04	1.051333D-02	8.734945D-03	4.201494D-01	4.597471D-01	1.007061D-01	9.773D-01	6.553D 01	3.349D 01
8	1.472236D-04	9.368042D-03	7.600606D-03	3.842266D-01	4.757489D-01	1.229087D-01	8.632D-01	6.268D 01	3.646D 01
9	1.456665D-04	8.630713D-03	6.753258D-03	3.504728D-01	4.860760D-01	1.479216D-01	7.838D-01	5.978D 01	3.943D 01
10	1.442308D-04	8.136076D-03	6.116492D-03	3.192590D-01	4.906744D-01	1.756698D-01	7.271D-01	5.687D 01	4.241D 01
11	4.288593D-05	5.492676D-03	4.930948D-03	3.021328D-01	5.051272D-01	1.822734D-01	5.255D-01	5.574D 01	4.373D 01
12	1.269529D-05	3.683297D-03	3.942277D-03	2.833550D-01	5.186820D-01	1.903248D-01	3.825D-01	5.445D 01	4.516D 01
13	3.741330D-06	2.452406D-03	3.123747D-03	2.631902D-01	5.309484D-01	2.002814D-01	2.792D-01	5.299D 01	4.673D 01
14	1.097445D-06	1.619916D-03	2.450502D-03	2.418735D-01	5.413683D-01	2.126867D-01	2.036D-01	5.134D 01	4.846D 01
15	3.203082D-07	1.060147D-03	1.900274D-03	2.196343D-01	5.492237D-01	2.281812D-01	1.481D-01	4.948D 01	5.037D 01
16	9.297316D-08	6.860322D-04	1.453532D-03	1.967122D-01	5.536452D-01	2.475029D-01	1.070D-01	4.739D 01	5.251D 01
17	2.681387D-08	4.376243D-04	1.093377D-03	1.733663D-01	5.536326D-01	2.714701D-01	7.655D-02	4.504D 01	5.488D 01
18	7.668370D-09	2.738729D-04	8.053265D-04	1.498824D-01	5.480960D-01	3.009424D-01	5.396D-02	4.241D 01	5.754D 01
19	2.162290D-09	1.668121D-04	5.770507D-04	1.265766D-01	5.359272D-01	3.367523D-01	3.719D-02	3.946D 01	6.050D 01
20	5.897455D-10	9.748465D-05	3.980946D-04	1.037939D-01	5.161048D-01	3.796058D-01	2.478D-02	3.619D 01	6.379D 01

Table 5. Effect of Number of Theoretical Stages

ISOTOPIIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 25 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 8 2ND PP LOCATION= 10 3RD PP LOCATION= 12
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.466774D 01 2.475099D 01 2.481339D 01 2.486541D 01 2.491170D 01 2.495469D 01
 2.499579D 01 2.503580D 01 2.507520D 01 2.511428D 01 2.515317D 01 2.519192D 01
 2.521428D 01 2.523489D 01 2.525499D 01 2.527527D 01 2.529627D 01 2.531839D 01
 2.534205D 01 2.536765D 01 2.539564D 01 2.542646D 01 2.546059D 01 2.549847D 01
 2.554049D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 1.000002D 00 1.000002D 00 1.000002D 00 1.000002D 00 1.000002D 00 1.000002D 00
 1.000002D 00 1.000002D 00 1.000002D 00 1.000002D 00 1.000001D 00 1.000001D 00
 1.000001D 00 1.000001D 00 1.000001D 00 1.000001D 00 1.000001D 00 1.000001D 00
 1.000001D 00 1.000001D 00 1.000001D 00 1.000001D 00 1.000001D 00 1.000001D 00
 1.000001D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666577D-03	8.993561D-02	3.623749D-02	6.742710D-01	1.848949D-01	7.996440D-03	6.975D 00	8.117D 01	1.186D 01
2	1.907656D-03	6.058847D-02	2.956933D-02	6.723207D-01	2.238600D-01	1.175387D-02	4.699D 00	8.145D 01	1.285D 01
3	6.217724D-04	4.121839D-02	2.395500D-02	6.558098D-01	2.618763D-01	1.651878D-02	3.321D 00	8.074D 01	1.594D 01
4	2.787687D-04	2.879355D-02	1.944046D-02	6.302204D-01	2.987501D-01	2.250673D-02	2.440D 00	7.940D 01	1.816D 01
5	1.873670D-04	2.095434D-02	1.590231D-02	5.989408D-01	3.340659D-01	2.994923D-02	1.862D 00	7.764D 01	2.049D 01
6	1.623633D-04	1.605474D-02	1.317380D-02	5.642926D-01	3.572258D-01	3.909062D-02	1.478D 00	7.559D 01	2.293D 01
7	1.547686D-04	1.300260D-02	1.109140D-02	5.279535D-01	3.976172D-01	5.018046D-02	1.220D 00	7.333D 01	2.545D 01
8	1.517382D-04	1.109441D-02	9.511702D-03	4.911691D-01	4.246107D-01	6.346231D-02	1.045D 00	7.090D 01	2.805D 01
9	1.499211D-04	9.886308D-03	8.315994D-03	4.548742D-01	4.476136D-01	7.915993D-02	9.251D-01	6.836D 01	3.071D 01
10	1.484423D-04	9.102620D-03	7.409451D-03	4.197674D-01	4.661108D-01	9.746130D-02	8.404D-01	6.574D 01	3.342D 01
11	1.470708D-04	8.574433D-03	6.718210D-03	3.863594D-01	4.796993D-01	1.185016D-01	7.793D-01	6.305D 01	3.617D 01
12	1.457438D-04	8.195463D-03	6.185848D-03	3.550063D-01	4.881167D-01	1.423459D-01	7.338D-01	6.032D 01	3.895D 01
13	1.444440D-04	7.916460D-03	5.769963D-03	3.259353D-01	4.912601D-01	1.689738D-01	6.988D-01	5.755D 01	4.175D 01
14	4.304071D-05	5.365583D-03	4.685554D-03	3.120278D-01	5.050711D-01	1.728069D-01	5.069D-01	5.672D 01	4.277D 01
15	1.277946D-05	3.618504D-03	3.782182D-03	2.966841D-01	5.186358D-01	1.772666D-01	3.713D-01	5.578D 01	4.385D 01
16	3.781277D-06	2.428163D-03	3.034341D-03	2.801253D-01	5.318224D-01	1.825861D-01	2.735D-01	5.472D 01	4.500D 01
17	1.114922D-06	1.620982D-03	2.418596D-03	2.625326D-01	5.443827D-01	1.890439D-01	2.021D-01	5.355D 01	4.624D 01
18	3.275509D-07	1.076112D-03	1.914144D-03	2.440597D-01	5.559585D-01	1.959812D-01	1.495D-01	5.226D 01	4.759D 01
19	9.586432D-08	7.099757D-04	1.502873D-03	2.248940D-01	5.660764D-01	2.068166D-01	1.107D-01	5.083D 01	4.906D 01
20	2.794227D-08	4.650869D-04	1.169215D-03	2.051644D-01	5.741429D-01	2.190584D-01	8.172D-02	4.925D 01	5.067D 01
21	8.108402D-09	3.020935D-04	8.999088D-04	1.850461D-01	5.794397D-01	2.343122D-01	6.010D-02	4.749D 01	5.245D 01
22	2.341274D-09	1.941762D-04	6.837413D-04	1.647149D-01	5.811270D-01	2.532802D-01	4.390D-02	4.554D 01	5.442D 01
23	6.720928D-10	1.231341D-04	5.112359D-04	1.443603D-01	5.878257D-01	2.767466D-01	3.172D-02	4.336D 01	5.661D 01
24	1.914300D-10	7.666707D-05	3.746578D-04	1.241886D-01	5.698174D-01	3.055426D-01	2.257D-02	4.091D 01	5.906D 01
25	5.379457D-11	4.649718D-05	2.672889D-04	1.044243D-01	5.547760D-01	3.404859D-01	1.569D-02	3.818D 01	6.180D 01
25	1.463182D-11	2.707742D-05	1.837246D-04	8.530914D-02	5.321903D-01	3.822897D-01	1.054D-02	3.514D 01	6.485D 01

Table 6. Effect of Number of Theoretical Stages

ISOTOPIIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND FP LOCATION= 15 3RD FP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.463442D 01 2.471111D 01 2.476739D 01 2.481355D 01 2.485418D 01 2.489165D 01
 2.492732D 01 2.496200D 01 2.499618D 01 2.503015D 01 2.506409D 01 2.509813D 01
 2.513235D 01 2.516681D 01 2.520154D 01 2.522205D 01 2.524050D 01 2.525808D 01
 2.527543D 01 2.529298D 01 2.531108D 01 2.533001D 01 2.535009D 01 2.537162D 01
 2.539495D 01 2.542050D 01 2.544869D 01 2.548002D 01 2.551496D 01 2.555392D 01

SUMMATION OF LIQUID MOLE FRACTIONS.....(FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 1.000010D 00 1.000010D 00 1.000010D 00 1.000010D 00 1.000010D 00 1.000010D 00
 1.000011D 00 1.000010D 00 1.000010D 00 1.000010D 00 1.000009D 00 1.000009D 00
 1.000008D 00 1.000007D 00 1.000006D 00 1.000006D 00 1.000007D 00 1.000007D 00
 1.000007D 00 1.000007D 00 1.000007D 00 1.000007D 00 1.000007D 00 1.000007D 00
 1.000007D 00 1.000006D 00 1.000006D 00 1.000006D 00 1.000005D 00 1.000005D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666129D-03	8.996687D-02	3.642225D-02	7.103798D-01	1.528073D-01	3.767222D-03	6.986D 00	8.318D 01	9.838D 00
1	1.918818D-03	6.109948D-02	2.997418D-02	7.146584D-01	1.867606D-01	5.592578D-03	4.746D 00	8.386D 01	1.140D 01
2	6.291332D-04	4.193648D-02	2.451480D-02	7.041378D-01	2.208321D-01	7.949712D-03	3.385D 00	8.355D 01	1.306D 01
3	2.829710D-04	2.955678D-02	2.009492D-02	6.841218D-01	2.549715D-01	1.097207D-02	2.511D 00	8.264D 01	1.485D 01
4	1.901754D-04	2.168218D-02	1.660324D-02	6.578189D-01	2.888927D-01	1.481276D-02	1.933D 00	8.131D 01	1.676D 01
5	1.647339D-04	1.671762D-02	1.388618D-02	6.274088D-01	3.221773D-01	1.964592D-02	1.547D 00	7.968D 01	1.877D 01
6	1.570939D-04	1.359647D-02	1.179198D-02	5.944686D-01	3.543199D-01	2.566594D-02	1.285D 00	7.784D 01	2.087D 01
7	1.541577D-04	1.162961D-02	1.018669D-02	5.601855D-01	3.847592D-01	3.308480D-02	1.106D 00	7.584D 01	2.306D 01
8	1.524779D-04	1.037659D-02	8.958611D-03	5.254766D-01	4.129082D-01	4.212761D-02	9.820D-01	7.371D 01	2.531D 01
9	1.511456D-04	9.561383D-03	8.017754D-03	4.910594D-01	4.381843D-01	5.302599D-02	8.941D-01	7.149D 01	2.761D 01
10	1.499178D-04	9.012837D-03	7.293296D-03	4.574548D-01	4.600398D-01	6.600936D-02	8.303D-01	6.920D 01	2.997D 01
11	1.487275D-04	8.625875D-03	6.730473D-03	4.252130D-01	4.779881D-01	8.129382D-02	7.827D-01	6.685D 01	3.237D 01
12	1.475539D-04	8.336577D-03	6.287532D-03	3.945320D-01	4.916275D-01	9.906880D-02	7.460D-01	6.445D 01	3.480D 01
13	1.463898D-04	8.106368D-03	5.933021D-03	3.656722D-01	5.006604D-01	1.194817D-01	7.166D-01	6.201D 01	3.728D 01
14	1.452318D-04	7.912149D-03	5.643507D-03	3.397697D-01	5.049082D-01	1.426212D-01	6.923D-01	5.952D 01	3.979D 01
15	1.440782D-04	7.740201D-03	5.401718D-03	3.138905D-01	5.043224D-01	1.685010D-01	6.715D-01	5.699D 01	4.234D 01
16	4.287398D-05	5.227941D-03	4.385234D-03	3.014505D-01	5.174682D-01	1.714152D-01	4.854D-01	5.628D 01	4.323D 01
17	1.271759D-05	3.529122D-03	3.541942D-03	2.877925D-01	5.304539D-01	1.746698D-01	3.548D-01	5.548D 01	4.417D 01
18	3.760957D-06	2.367785D-03	2.846480D-03	2.731270D-01	5.432409D-01	1.784141D-01	2.611D-01	5.459D 01	4.515D 01
19	1.108900D-06	1.581917D-03	2.275804D-03	2.576213D-01	5.556992D-01	1.828207D-01	1.930D-01	5.363D 01	4.618D 01
20	3.259660D-07	1.052274D-03	1.809637D-03	2.414206D-01	5.676171D-01	1.881000D-01	1.431D-01	5.258D 01	4.728D 01
21	9.552096D-08	6.967210D-04	1.430467D-03	2.246533D-01	5.787012D-01	1.945132D-01	1.064D-01	5.144D 01	4.846D 01
22	2.790933D-08	4.589748D-04	1.123348D-03	2.074617D-01	5.885707D-01	2.023852D-01	7.912D-02	5.020D 01	4.972D 01
23	8.121187D-09	3.006409D-04	8.756354D-04	1.899563D-01	5.967502D-01	2.121172D-01	5.881D-02	4.885D 01	5.109D 01
24	2.355146D-09	1.956340D-04	6.767047D-04	1.722674D-01	6.026620D-01	2.241982D-01	4.362D-02	4.737D 01	5.259D 01
25	6.802321D-10	1.263006D-04	5.176793D-04	1.545225D-01	6.056212D-01	2.392123D-01	3.220D-02	4.574D 01	5.423D 01
26	1.955802D-10	8.073829D-05	3.911809D-04	1.368530D-01	6.048366D-01	2.578384D-01	2.360D-02	4.393D 01	5.604D 01
27	5.593099D-11	5.095230D-05	2.911054D-04	1.193966D-01	5.994231D-01	2.808382D-01	1.710D-02	4.191D 01	5.807D 01
28	1.587816D-11	3.159296D-05	2.124246D-04	1.022991D-01	5.884317D-01	3.090251D-01	1.220D-02	3.965D 01	6.033D 01
29	4.449672D-12	1.909415D-05	1.510130D-04	8.571655D-02	5.709038D-01	3.432095D-01	8.505D-03	3.712D 01	6.287D 01
30	1.207618D-12	1.108794D-05	1.034962D-04	6.981538D-02	5.459556D-01	3.841145D-01	5.729D-03	3.428D 01	6.571D 01

Table 7. Effect of Reflux Ratio

ISOTOPIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 5.000D 00
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND FP LOCATION= 12 3RD FP LOCATION= 15
 FEED RATES: G.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 ΔPH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.481375D 01 2.490605D 01 2.496860D 01 2.501519D 01 2.505209D 01 2.508263D 01
 2.510877D 01 2.513173D 01 2.515230D 01 2.517102D 01 2.518825D 01 2.520426D 01
 2.521924D 01 2.523332D 01 2.524658D 01 2.525934D 01 2.526930D 01 2.527781D 01
 2.528554D 01 2.529294D 01 2.530039D 01 2.530829D 01 2.531708D 01 2.532731D 01
 2.533969D 01 2.535515D 01 2.537496D 01 2.540082D 01 2.543495E 01 2.548018D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00
 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00
 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00
 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	ΔPH	APD	APT
1	6.666667D-03	8.930623D-02	3.351641D-02	5.194911D-01	3.205416D-01	3.047799D-02	6.808D 00	7.244D 01	2.075D 01
1	1.859134D-03	5.808942D-02	2.635299D-02	4.982974D-01	3.724958D-01	4.290524D-02	4.408D 00	7.136D 01	2.423D 01
2	7.299733D-04	4.027225D-02	2.116153D-02	4.698073D-01	4.120799D-01	5.594904D-02	3.145D 00	6.960D 01	2.726D 01
3	4.666479D-04	3.037075D-02	1.756077D-02	4.403154D-01	4.417241D-01	6.956234D-02	2.443D 00	6.764D 01	2.992D 01
4	4.037947D-04	2.492190D-02	1.511477D-02	4.126464D-01	4.632337D-01	8.368551D-02	2.042D 00	6.567D 01	3.229D 01
5	3.871967D-04	2.191498D-02	1.346688D-02	3.879201D-01	4.780585D-01	9.825239D-02	1.808D 00	6.379D 01	3.440D 01
6	3.814642D-04	2.022889D-02	1.235573D-02	3.664435D-01	4.873991D-01	1.131914D-01	1.667D 00	6.203D 01	3.631D 01
7	3.784698D-04	1.925289D-02	1.159971D-02	3.480806D-01	4.922627D-01	1.284257D-01	1.580D 00	6.038D 01	3.804D 01
8	3.763059D-04	1.865888D-02	1.107652D-02	3.325145D-01	4.934996D-01	1.438742D-01	1.524D 00	5.886D 01	3.962D 01
9	3.744918D-04	1.827207D-02	1.070539D-02	3.193651D-01	4.918305D-01	1.594525D-01	1.486D 00	5.744D 01	4.107D 01
10	3.728830D-04	1.799963D-02	1.043368D-02	3.082540D-01	4.878657D-01	1.750741D-01	1.459D 00	5.612D 01	4.242D 01
11	3.714218D-04	1.779218D-02	1.022734D-02	2.988355D-01	4.821219D-01	1.906518D-01	1.438D 00	5.488D 01	4.368D 01
12	3.700769D-04	1.762332D-02	1.006448D-02	2.908085D-01	4.750346D-01	2.060990D-01	1.421D 00	5.371D 01	4.486D 01
13	3.688285D-04	1.747876D-02	9.931052D-03	2.839198D-01	4.669698D-01	2.213318D-01	1.407D 00	5.261D 01	4.598D 01
14	3.676627D-04	1.735061D-02	9.818052D-03	2.779605D-01	4.582333D-01	2.362699D-01	1.395D 00	5.158D 01	4.703D 01
15	3.665700D-04	1.723444D-02	9.719683D-03	2.727616D-01	4.490793D-01	2.508385D-01	1.384D 00	5.059D 01	4.802D 01
16	1.313720D-04	1.394966D-02	9.131074D-03	2.732796D-01	4.517292D-01	2.517791D-01	1.167D 00	5.061D 01	4.822D 01
17	4.700050D-05	1.125199D-02	8.534901D-03	2.731983D-01	4.542890D-01	2.526789D-01	9.940D-01	5.060D 01	4.841D 01
18	1.679056D-05	9.045077D-03	7.937059D-03	2.725098D-01	4.568840D-01	2.536072D-01	8.508D-01	5.055D 01	4.860D 01
19	5.990308D-06	7.244800D-03	7.341444D-03	2.711615D-01	4.596116D-01	2.546347D-01	7.299D-01	5.046D 01	4.881D 01
20	2.134413D-06	5.779520D-03	6.750753D-03	2.690639D-01	4.625545D-01	2.558491D-01	6.267D-01	5.032D 01	4.905D 01
21	7.595351D-07	4.589074D-03	6.166861D-03	2.660900D-01	4.657818D-01	2.573715D-01	5.379D-01	5.013D 01	4.933D 01
22	2.699112D-07	3.623383D-03	5.591041D-03	2.620700D-01	4.693395D-01	2.593758D-01	4.607D-01	4.986D 01	4.968D 01
23	9.576815D-08	2.841032D-03	5.024112D-03	2.567838D-01	4.732318D-01	2.621192D-01	3.933D-01	4.948D 01	5.012D 01
24	3.391661D-08	2.207949D-03	4.466574D-03	2.499514D-01	4.773818D-01	2.659859D-01	3.337D-01	4.897D 01	5.069D 01
25	1.198267D-08	1.696227D-03	3.918745D-03	2.412232D-01	4.816102D-01	2.715517D-01	2.807D-01	4.829D 01	5.143D 01
26	4.218752D-09	1.283110D-03	3.380920D-03	2.301703D-01	4.854892D-01	2.796765D-01	2.332D-01	4.736D 01	5.241D 01
27	1.476796D-09	9.501260D-04	2.853591D-03	2.162812D-01	4.882850D-01	2.916301D-01	1.902D-01	4.609D 01	5.372D 01
28	5.112169D-10	6.823718D-04	2.337765D-03	1.989710D-01	4.887587D-01	3.092502D-01	1.510D-01	4.437D 01	5.548D 01
29	1.724794D-10	4.679200D-04	1.835418D-03	1.776177D-01	4.849665D-01	3.351125D-01	1.152D-01	4.203D 01	5.785D 01
30	5.427012D-11	2.973313D-04	1.350111D-03	1.516467D-01	4.740536D-01	3.726523D-01	8.237D-02	3.888D 01	6.104D 01

Table 8. Effect of Reflux Ratio

ISOTOPIIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.000D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND PP LOCATION= 15 3RD PP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.468617D 01 2.476909D 01 2.482925D 01 2.487761D 01 2.491906D 01 2.495613D 01
 2.499030D 01 2.502249D 01 2.505329D 01 2.508311D 01 2.511223D 01 2.514089D 01
 2.516924D 01 2.519741D 01 2.522547D 01 2.524235D 01 2.525666D 01 2.526979D 01
 2.528252D 01 2.529538D 01 2.530881D 01 2.532319D 01 2.533893D 01 2.535645D 01
 2.537625D 01 2.539889D 01 2.542505D 01 2.545550D 01 2.549109D 01 2.553270D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00
 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00
 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00
 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00 1.000000D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666661D-03	8.992426D-02	3.606983D-02	6.511136D-01	2.084272D-01	7.798561D-03	6.366D 00	8.003D 01	1.300D 01
1	1.901469D-03	6.031202D-02	2.929446D-02	6.460488D-01	2.510429D-01	1.140041D-02	4.670D 00	8.017D 01	1.516D 01
2	6.562108D-04	4.142187D-02	2.378505D-02	6.274998D-01	2.908427D-01	1.579442D-02	3.326D 00	7.936D 01	1.731D 01
3	3.344600D-04	2.970068D-02	1.950307D-02	6.014932D-01	3.278539D-01	2.111474D-02	2.494D 00	7.803D 01	1.948D 01
4	2.509710D-04	2.253383D-02	1.625497D-02	5.715843D-01	3.618763D-01	2.749961D-02	1.965D 00	7.638D 01	2.166D 01
5	2.283758D-04	1.817994D-02	1.392565D-02	5.400346D-01	3.926402D-01	3.509123D-02	1.623D 00	7.454D 01	2.383D 01
6	2.213118D-04	1.553292D-02	1.202246D-02	5.083207D-01	4.198704D-01	4.403306D-02	1.400D 00	7.260D 01	2.600D 01
7	2.182578D-04	1.390551D-02	1.068724D-02	4.774050D-01	4.433183D-01	5.446565D-02	1.251D 00	7.060D 01	2.815D 01
8	2.162889D-04	1.288494D-02	9.696102D-03	4.478978D-01	4.627834D-01	6.652152D-02	1.151D 00	6.857D 01	3.028D 01
9	2.146525D-04	1.222162D-02	8.954929D-03	4.201626D-01	4.781270D-01	8.031920D-02	1.080D 00	6.653D 01	3.239D 01
10	2.131460D-04	1.176826D-02	8.393670D-03	3.943884D-01	4.892802D-01	9.595634D-02	1.029D 00	6.449D 01	3.448D 01
11	2.117974D-04	1.143299D-02	7.961014D-03	3.706397D-01	4.962472D-01	1.135021D-01	9.911D-01	6.245D 01	3.656D 01
12	2.103126D-04	1.118118D-02	7.619839D-03	3.488944D-01	4.991052D-01	1.329891D-01	9.611D-01	6.040D 01	3.864D 01
13	2.089492D-04	1.096750D-02	7.343567D-03	3.290723D-01	4.980023D-01	1.544053D-01	9.354D-01	5.836D 01	4.071D 01
14	2.076093D-04	1.078022D-02	7.113353D-03	3.110569D-01	4.931549D-01	1.776871D-01	9.154D-01	5.630D 01	4.278D 01
15	2.062882D-04	1.060949D-02	6.915963D-03	2.947122D-01	4.848424D-01	2.027137D-01	8.969D-01	5.424D 01	4.486D 01
16	6.471023D-05	7.556579D-03	5.885969D-03	2.891975D-01	4.926177D-01	2.046775D-01	6.786D-01	5.393D 01	4.539D 01
17	2.024877D-05	5.363126D-03	4.986148D-03	2.824263D-01	5.004112D-01	2.067930D-01	5.195D-01	5.353D 01	4.595D 01
18	6.321796D-06	3.793613D-03	4.204509D-03	2.744867D-01	5.083234D-01	2.091855D-01	4.005D-01	5.305D 01	4.654D 01
19	1.969377D-06	2.674330D-03	3.528426D-03	2.654225D-01	5.163778D-01	2.119949D-01	3.103D-01	5.249D 01	4.719D 01
20	6.121453D-07	1.878493D-03	2.945679D-03	2.552523D-01	5.245297D-01	2.153931D-01	2.413D-01	5.185D 01	4.791D 01
21	1.898347D-07	1.314203D-03	2.444900D-03	2.439806D-01	5.326597D-01	2.196004D-01	1.880D-01	5.110D 01	4.872D 01
22	5.872463D-08	9.151763D-04	2.015759D-03	2.316046D-01	5.405600D-01	2.249044D-01	1.466D-01	5.023D 01	4.962D 01
23	1.811698D-08	6.337898D-04	1.649910D-03	2.181205D-01	5.479138D-01	2.316828D-01	1.141D-01	4.924D 01	5.065D 01
24	5.572268D-09	4.359373D-04	1.336463D-03	2.035292D-01	5.542692D-01	2.404292D-01	8.862D-02	4.809D 01	5.182D 01
25	1.707905D-09	2.972596D-04	1.079923D-03	1.878423D-01	5.590087D-01	2.517808D-01	6.841D-02	4.675D 01	5.318D 01
26	5.212963D-10	2.004023D-04	8.461074D-04	1.710893D-01	5.613181D-01	2.665461D-01	5.233D-02	4.518D 01	5.476D 01
27	1.582532D-10	1.330311D-04	6.565645D-04	1.533274D-01	5.601587D-01	2.857243D-01	3.948D-02	4.335D 01	5.661D 01
28	4.764464D-11	8.639958D-05	4.975900D-04	1.346533D-01	5.542556D-01	3.105071D-01	2.920D-02	4.118D 01	5.879D 01
29	1.411005D-11	5.431995D-05	3.651450D-04	1.152167D-01	5.422168D-01	3.422470D-01	2.097D-02	3.863D 01	6.135D 01
30	4.002035D-12	3.242396D-05	2.557731D-04	9.523681D-02	5.221028D-01	3.823722D-01	1.441D-02	3.563D 01	6.436D 01

Table 9. Effect of Reflux Ratio

ISOTOPIIC SEPARATION AT P_T= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND PP LOCATION= 12 3RD PP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BCTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.463442D 01 2.471111D 01 2.476739D 01 2.481355D 01 2.485418D 01 2.489165D 01
 2.492732D 01 2.496200D 01 2.499618D 01 2.503015D 01 2.506409D 01 2.509813D 01
 2.513235D 01 2.516681D 01 2.520154D 01 2.522205D 01 2.524050D 01 2.525808D 01
 2.527543D 01 2.529298D 01 2.531108D 01 2.533001D 01 2.535009D 01 2.537162D 01
 2.539495D 01 2.542050D 01 2.544869D 01 2.548002D 01 2.551496D 01 2.555392D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 1.000010D 00 1.000010D 00 1.000010D 00 1.000010D 00 1.000010D 00 1.000010D 00
 1.000011D 00 1.000010D 00 1.000010D 00 1.000010D 00 1.000009D 00 1.000009D 00
 1.000008D 00 1.000007D 00 1.000006D 00 1.000006D 00 1.000007D 00 1.000007D 00
 1.000007D 00 1.000007D 00 1.000007D 00 1.000007D 00 1.000007D 00 1.000007D 00
 1.000007D 00 1.000006D 00 1.000006D 00 1.000006D 00 1.000005D 00 1.000005D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666129D-03	8.996687D-02	3.642225D-02	7.103798D-01	1.528073D-01	3.767222D-03	6.986D 00	8.318D 01	9.838D 00
1	1.918818D-03	6.109948D-02	2.997418D-02	7.146544D-01	1.867606D-01	5.592578D-03	4.746D 00	8.386D 01	1.140D 01
2	6.291332D-04	4.193648D-02	2.451480D-02	7.041378D-01	2.208321D-01	7.949712D-03	3.385D 00	8.355D 01	1.306D 01
3	2.829710D-04	2.955678D-02	2.009492D-02	6.841218D-01	2.549715D-01	1.097207D-02	2.511D 00	8.264D 01	1.485D 01
4	1.901754D-04	2.168218D-02	1.660324D-02	6.578189D-01	2.888927D-01	1.481276D-02	1.933D 00	8.131D 01	1.676D 01
5	1.647339D-04	1.671702D-02	1.388618D-02	6.274088D-01	3.221773D-01	1.964592D-02	1.547D 00	7.968D 01	1.877D 01
6	1.570939D-04	1.359647D-02	1.179198D-02	5.944686D-01	3.543199D-01	2.566594D-02	1.285D 00	7.784D 01	2.087D 01
7	1.541577D-04	1.162961D-02	1.018669D-02	5.601855D-01	3.847592D-01	3.308480D-02	1.106D 00	7.584D 01	2.306D 01
8	1.524779D-04	1.037659D-02	8.958611D-03	5.254766D-01	4.129082D-01	4.212761D-02	9.820D-01	7.371D 01	2.531D 01
9	1.511456D-04	9.561383D-03	8.017754D-03	4.710594D-01	4.381843D-01	5.302599D-02	8.941D-01	7.149D 01	2.761D 01
10	1.499178D-04	9.012837D-03	7.293296D-03	4.574948D-01	4.600398D-01	6.600936D-02	8.303D-01	6.920D 01	2.997D 01
11	1.487275D-04	8.625875D-03	6.730473D-03	4.252130D-01	4.779881D-01	8.129382D-02	7.827D-01	6.685D 01	3.237D 01
12	1.475539D-04	8.336577D-03	6.287532D-03	3.945320D-01	4.916275D-01	9.906880D-02	7.460D-01	6.445D 01	3.480D 01
13	1.463898D-04	8.106368D-03	5.933021D-03	3.656722D-01	5.006604D-01	1.194817D-01	7.166D-01	6.201D 01	3.728D 01
14	1.452318D-04	7.912149D-03	5.643507D-03	3.387697D-01	5.049082D-01	1.426212D-01	6.923D-01	5.952D 01	3.979D 01
15	1.440782D-04	7.740201D-03	5.401718D-03	3.138905D-01	5.043224D-01	1.685010D-01	6.715D-01	5.699D 01	4.234D 01
16	4.287398D-05	5.237941D-03	4.385234D-03	3.014505D-01	5.174682D-01	1.714152D-01	4.854D-01	5.628D 01	4.323D 01
17	1.271759D-05	3.529122D-03	3.541942D-03	2.877925D-01	5.304539D-01	1.746698D-01	3.548D-01	5.548D 01	4.417D 01
18	3.760957D-06	2.367785D-03	2.846480D-03	2.731270D-01	5.432409D-01	1.785414D-01	2.611D-01	5.459D 01	4.515D 01
19	1.108900D-06	1.581917D-03	2.275804D-03	2.576213D-01	5.556992D-01	1.828207D-01	1.930D-01	5.363D 01	4.618D 01
20	3.259660D-07	1.052274D-03	1.809637D-03	2.414206D-01	5.676171D-01	1.881000D-01	1.431D-01	5.258D 01	4.728D 01
21	9.552096D-08	6.967210D-04	1.430467D-03	2.246583D-01	5.787012D-01	1.945132D-01	1.064D-01	5.144D 01	4.846D 01
22	2.790033D-08	4.589748D-04	1.123348D-03	2.074617D-01	5.885707D-01	2.023852D-01	7.912D-02	5.020D 01	4.972D 01
23	8.121187D-09	3.006409D-04	8.756354D-04	1.899563D-01	5.967502D-01	2.121172D-01	5.881D-02	4.885D 01	5.109D 01
24	2.355146D-09	1.956340D-04	6.767047D-04	1.722674D-01	6.026620D-01	2.241982D-01	4.362D-02	4.737D 01	5.259D 01
25	6.802321D-10	1.263006D-04	5.176793D-04	1.545225D-01	6.056212D-01	2.392123D-01	3.220D-02	4.574D 01	5.423D 01
26	1.955802D-10	8.073829D-05	3.911809D-04	1.368530D-01	6.048366D-01	2.578384D-01	2.360D-02	4.393D 01	5.604D 01
27	5.593099D-11	5.095230D-05	2.911054D-04	1.193966D-01	5.994231D-01	2.808382D-01	1.710D-02	4.191D 01	5.807D 01
28	1.587816D-11	3.159296D-05	2.124246D-04	1.022991D-01	5.884370D-01	3.090251D-01	1.220D-02	3.965D 01	6.033D 01
29	4.449672D-12	1.909415D-05	1.510130D-04	8.571655D-02	5.709010D-01	3.432095D-01	8.505D-03	3.712D 01	6.287D 01
30	1.207618D-12	1.108794D-05	1.034962D-04	6.981538D-02	5.459556D-01	3.841145D-01	5.729D-03	3.428D 01	6.571D 01

Table 10. Effect of Reflux Ratio

ISOTOPIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 2.000D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND FP LOCATION= 12 3RD FP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000009D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.460980D 01 2.468292D 01 2.473657D 01 2.478077D 01 2.482002D 01 2.485668D 01
 2.489212D 01 2.492715D 01 2.496226D 01 2.499768D 01 2.503357D 01 2.506997D 01
 2.510689D 01 2.514435D 01 2.518230D 01 2.520567D 01 2.522730D 01 2.524819D 01
 2.526885D 01 2.528963D 01 2.531079D 01 2.533257D 01 2.535523D 01 2.537904D 01
 2.540428D 01 2.543131D 01 2.546047D 01 2.549212D 01 2.552660D 01 2.556415D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 1.000045D 00 1.000045D 00 1.000047D 00 1.000050D 00 1.000052D 00 1.000054D 00
 1.000056D 00 1.000056D 00 1.000057D 00 1.000056D 00 1.000054D 00 1.000052D 00
 1.000048D 00 1.000044D 00 1.000040D 00 1.000041D 00 1.000042D 00 1.000042D 00
 1.000042D 00 1.000042D 00 1.000041D 00 1.000040D 00 1.000038D 00 1.000037D 00
 1.000035D 00 1.000032D 00 1.000030D 00 1.000027D 00 1.000025D 00 1.000022D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.663139D-03	8.993888D-02	3.650870D-02	7.391280D-01	1.254135D-01	2.392318D-03	6.989D 00	8.468D 01	8.335D 00
1	1.926314D-03	6.144412D-02	3.023454D-02	7.484695D-01	1.543480D-01	3.577550D-03	4.776D 00	8.563D 01	9.586D 00
2	6.141204D-04	4.215361D-02	2.481845D-02	7.428467D-01	1.844148D-01	5.152302D-03	3.410D 00	8.561D 01	1.098D 01
3	2.550413D-04	2.943904D-02	2.034587D-02	7.270761D-01	2.156530D-01	7.230870D-03	2.515D 00	8.496D 01	1.252D 01
4	1.571391D-04	2.118948D-02	1.674170D-02	7.040731D-01	2.478876D-01	9.950964D-03	1.912D 00	8.386D 01	1.423D 01
5	1.300870D-04	1.588863D-02	1.388170D-02	6.758292D-01	2.807937D-01	1.347666D-02	1.501D 00	8.241D 01	1.608D 01
6	1.221242D-04	1.249999D-02	1.163537D-02	6.438207D-01	3.139218D-01	1.799995D-02	1.219D 00	8.070D 01	1.808D 01
7	1.192846D-04	1.033469D-02	9.882900D-03	6.092086D-01	3.467140D-01	2.374051D-02	1.023D 00	7.877D 01	2.020D 01
8	1.178187D-04	8.943514D-03	8.521050D-03	5.729493D-01	3.785248D-01	3.094349D-02	8.850D-01	7.666D 01	2.245D 01
9	1.167214D-04	8.037611D-03	7.464119D-03	5.358584D-01	4.086483D-01	3.987487D-02	7.867D-01	7.442D 01	2.479D 01
10	1.157222D-04	7.433450D-03	6.642676D-03	4.986430D-01	4.363512D-01	5.081395D-02	7.153D-01	7.205D 01	2.723D 01
11	1.147478D-04	7.015622D-03	6.001474D-03	4.619158D-01	4.609096D-01	6.404276D-02	6.623D-01	6.958D 01	2.975D 01
12	1.137779D-04	6.712263D-03	5.497175D-03	4.261990D-01	4.816457D-01	7.983206D-02	6.218D-01	6.703D 01	3.234D 01
13	1.128072D-04	6.479049D-03	5.096195D-03	3.919240D-01	4.979638D-01	9.842417D-02	5.900D-01	6.441D 01	3.499D 01
14	1.118348D-04	6.288898D-03	4.772797D-03	3.594311D-01	5.093824D-01	1.200129D-01	5.642D-01	6.172D 01	3.771D 01
15	1.108608D-04	6.125429D-03	4.507470D-03	3.289722D-01	5.155619D-01	1.447211D-01	5.427D-01	5.898D 01	4.047D 01
16	3.207999D-05	4.035225D-03	3.566610D-03	3.110862D-01	5.329380D-01	1.483418D-01	3.833D-01	5.795D 01	4.166D 01
17	9.248401D-06	2.644781D-03	2.806206D-03	2.922473D-01	5.498421D-01	1.524503D-01	2.735D-01	5.685D 01	4.288D 01
18	2.656641D-06	1.724923D-03	2.195651D-03	2.727551D-01	5.661099D-01	1.572117D-01	1.963D-01	5.566D 01	4.413D 01
19	7.604168D-07	1.119479D-03	1.708261D-03	2.528606D-01	5.814925D-01	1.628184D-01	1.415D-01	5.441D 01	4.544D 01
20	2.168780D-07	7.229217D-04	1.321305D-03	2.327838D-01	5.956696D-01	1.695021D-01	1.022D-01	5.310D 01	4.680D 01
21	6.163071D-08	4.644250D-04	1.015699D-03	2.127225D-01	6.082541D-01	1.775432D-01	7.401D-02	5.171D 01	4.822D 01
22	1.744822D-08	2.967280D-04	7.755862D-04	1.928554D-01	6.187934D-01	1.872789D-01	5.362D-02	5.024D 01	4.970D 01
23	4.920541D-09	1.884618D-04	5.879073D-04	1.733444D-01	6.267705D-01	1.991087D-01	3.882D-02	4.868D 01	5.128D 01
24	1.381963D-09	1.189097D-04	4.419819D-04	1.543356D-01	6.316060D-01	2.134975D-01	2.804D-02	4.702D 01	5.295D 01
25	3.864438D-10	7.445680D-05	3.291352D-04	1.359606D-01	6.326639D-01	2.309718D-01	2.018D-02	4.523D 01	5.474D 01
26	1.075519D-10	4.619815D-05	2.423643D-04	1.183379D-01	6.292656D-01	2.521080D-01	1.443D-02	4.330D 01	5.668D 01
27	2.977221D-11	2.833702D-05	1.760493D-04	1.015742D-01	6.207130D-01	2.775084D-01	1.022D-02	4.119D 01	5.879D 01
28	8.185258D-12	1.711788D-05	1.257052D-04	8.576655D-02	6.063277D-01	3.077630D-01	7.141D-03	3.889D 01	6.110D 01
29	2.225464D-12	1.011929D-05	8.777087D-05	7.100301D-02	5.855056D-01	3.433935D-01	4.894D-03	3.638D 01	6.362D 01
30	5.895360D-13	5.787536D-06	5.943169D-05	5.736297D-02	5.577887D-01	3.847831D-01	3.261D-03	3.363D 01	6.637D 01

Table 11. Effect of Reflux Ratio

ISOTOPIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 2.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND PP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 0.0 0.0 0.0 0.0 0.0
 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.459636D 01 2.466735D 01 2.471931D 01 2.475214D 01 2.480027D 01 2.483609D 01
 2.487099D 01 2.490581D 01 2.494103D 01 2.497691D 01 2.501356D 01 2.505100D 01
 2.508919D 01 2.512810D 01 2.516764D 01 2.519315D 01 2.521716D 01 2.524045D 01
 2.526347D 01 2.528650D 01 2.530975D 01 2.533343D 01 2.535778D 01 2.538304D 01
 2.540949D 01 2.543744D 01 2.546720D 01 2.549906D 01 2.553328D 01 2.557001D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 1.000095D 00 1.000098D 00 1.000104D 00 1.000110D 00 1.000117D 00 1.000123D 00
 1.000129D 00 1.000133D 00 1.000135D 00 1.000135D 00 1.000133D 00 1.000129D 00
 1.000123D 00 1.000114D 00 1.000104D 00 1.000106D 00 1.000107D 00 1.000107D 00
 1.000105D 00 1.000103D 00 1.000099D 00 1.000095D 00 1.000090D 00 1.000085D 00
 1.000079D 00 1.000073D 00 1.000067D 00 1.000061D 00 1.000054D 00 1.000048D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.657375D-03	8.986595D-02	3.652088D-02	7.550891D-01	1.102155D-01	1.746614D-03	6.985D 00	8.551D 01	7.511D 00
1	1.929183D-03	6.159199D-02	3.034763D-02	7.673541D-01	1.361548D-01	2.622311D-03	4.789D 00	8.661D 01	8.587D 00
2	6.041384D-04	4.223065D-02	2.495958D-02	7.647428D-01	1.636574D-01	3.805391D-03	3.420D 00	8.676D 01	9.810D 00
3	2.373349D-04	2.931795D-02	2.045883D-02	7.517601D-01	1.928320D-01	5.393788D-03	2.512D 00	8.627D 01	1.120D 01
4	1.362964D-04	2.084127D-02	1.679004D-02	7.311247D-01	2.235989D-01	7.508837D-03	1.895D 00	8.533D 01	1.277D 01
5	1.082325D-04	1.533305D-02	1.384552D-02	7.046837D-01	2.557305D-01	1.029907D-02	1.470D 00	8.401D 01	1.451D 01
6	1.000637D-04	1.177578D-02	1.150724D-02	6.738104D-01	2.888634D-01	1.394311D-02	1.174D 00	8.240D 01	1.641D 01
7	9.729073D-05	9.483714D-03	9.664108D-03	6.396009D-01	3.225028D-01	1.865124D-02	9.670D-01	8.055D 01	1.847D 01
8	9.597389D-05	8.003249D-03	8.218468D-03	6.029846D-01	3.560326D-01	2.466508D-02	8.206D-01	7.849D 01	2.068D 01
9	9.504546D-05	7.038523D-03	7.087803D-03	5.647890D-01	3.887347D-01	3.225494D-02	7.157D-01	7.626D 01	2.301D 01
10	9.421594D-05	6.398757D-03	6.204104D-03	5.257705D-01	4.198181D-01	4.171425D-02	6.395D-01	7.388D 01	2.547D 01
11	9.340682D-05	5.962199D-03	5.512311D-03	4.866258D-01	4.484558D-01	5.335054D-02	5.830D-01	7.137D 01	2.803D 01
12	9.259725D-05	5.651907D-03	4.968473D-03	4.479880D-01	4.738264D-01	6.747267D-02	5.402D-01	6.876D 01	3.068D 01
13	9.178244D-05	5.419735D-03	4.537920D-03	4.104181D-01	4.351583D-01	8.437416D-02	5.070D-01	6.606D 01	3.342D 01
14	9.096217D-05	5.235854D-03	4.193600D-03	3.743941D-01	5.117726D-01	1.043129D-01	4.805D-01	6.328D 01	3.623D 01
15	9.013761D-05	5.081978D-03	3.914622D-03	3.403029D-01	5.231226D-01	1.274878D-01	4.588D-01	6.043D 01	3.910D 01
16	2.563678D-05	3.293067D-03	3.048620D-03	3.183179D-01	5.436920D-01	1.316228D-01	3.196D-01	5.917D 01	4.049D 01
17	7.261390D-06	2.121908D-03	2.359668D-03	2.956750D-01	5.634711D-01	1.363651D-01	2.248D-01	5.784D 01	4.192D 01
18	2.048470D-06	1.359808D-03	1.815424D-03	2.727346D-01	5.821984D-01	1.418898D-01	1.589D-01	5.645D 01	4.339D 01
19	5.755926D-07	8.667072D-04	1.388266D-03	2.498000D-01	5.995422D-01	1.484023D-01	1.128D-01	5.499D 01	4.488D 01
20	1.610936D-07	5.494068D-04	1.055059D-03	2.271326D-01	6.151159D-01	1.561469D-01	8.027D-02	5.349D 01	4.642D 01
21	4.490593D-08	3.463303D-04	7.966830D-04	2.049578D-01	6.284856D-01	1.654135D-01	5.715D-02	5.193D 01	4.800D 01
22	1.246625D-08	2.170543D-04	5.975028D-04	1.834685D-01	6.391753D-01	1.765416D-01	4.073D-02	5.031D 01	4.964D 01
23	3.446670D-09	1.352006D-04	4.448476D-04	1.628266D-01	6.466718D-01	1.899215D-01	2.900D-02	4.862D 01	5.134D 01
24	9.487546D-10	8.365506D-05	3.285326D-04	1.431652D-01	6.504305D-01	2.059921D-01	2.061D-02	4.684D 01	5.313D 01
25	2.599735D-10	5.137585D-05	2.404328D-04	1.245906D-01	6.498868D-01	2.252307D-01	1.459D-02	4.495D 01	5.503D 01
26	7.089081D-11	3.127817D-05	1.741128D-04	1.071859D-01	6.444729D-01	2.481358D-01	1.027D-02	4.294D 01	5.704D 01
27	1.922686D-11	1.884063D-05	1.245102D-04	9.101325D-02	6.336450D-01	2.751984D-01	7.167D-03	4.078D 01	5.920D 01
28	5.180534D-12	1.119330D-05	8.766766D-05	7.611707D-02	6.169221D-01	3.068620D-01	4.943D-03	3.846D 01	6.153D 01
29	1.381915D-12	6.524231D-06	6.051006D-05	6.252651D-02	5.939355D-01	3.434710D-01	3.352D-03	3.595D 01	6.404D 01
30	3.605250D-13	3.695658D-06	4.066108D-05	5.025653D-02	5.644882D-01	3.852109D-01	2.218D-03	3.325D 01	6.674D 01

Table 12. Effect of Operating Pressure

ISOTOPIIC SEPARATION AT PT= 5.000D 02 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND FP LOCATION= 12 3RD FP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00L 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.224057D 01 2.231051D 01 2.236306D 01 2.240634D 01 2.244502D 01 2.248173D 01
 2.251793D 01 2.255436D 01 2.259138D 01 2.262911D 01 2.266758D 01 2.270682D 01
 2.274683D 01 2.278767D 01 2.282938D 01 2.285392D 01 2.287620D 01 2.289730D 01
 2.291786D 01 2.293830D 01 2.295889D 01 2.297991D 01 2.300162D 01 2.302437D 01
 2.304858D 01 2.307478D 01 2.310360D 01 2.313572D 01 2.317187D 01 2.321268D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 1.000308D 00 1.000330D 00 1.000358D 00 1.000389D 00 1.000418D 00 1.000444D 00
 1.000464D 00 1.000475D 00 1.000477D 00 1.000469D 00 1.000451D 00 1.000423D 00
 1.000388D 00 1.000346D 00 1.000300D 00 1.000312D 00 1.000319D 00 1.000322D 00
 1.000322D 00 1.000317D 00 1.000310D 00 1.000299D 00 1.000285D 00 1.000269D 00
 1.000251D 00 1.000232D 00 1.000211D 00 1.000190D 00 1.000168D 00 1.000146D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.642038D-03	8.966293D-02	3.645329D-02	7.666511D-01	9.975628D-02	1.142308D-03	6.970D 00	8.614D 01	6.925D 00
1	2.637047D-03	5.728725D-02	2.938929D-02	7.802217D-01	1.286015D-01	1.863214D-03	4.596D 00	8.729D 01	8.083D 00
2	1.126617D-03	3.714960D-02	2.354428D-02	7.756524D-01	1.596350D-01	2.892042D-03	3.146D 00	8.738D 01	9.445D 00
3	5.666082D-04	2.494666D-02	1.891252D-02	7.584564D-01	1.927748D-01	4.343013D-03	2.249D 00	8.670D 01	1.101D 01
4	3.605629D-04	1.766930D-02	1.533645D-02	7.324516D-01	2.278160D-01	6.366108D-03	1.686D 00	8.549D 01	1.279D 01
5	2.842736D-04	1.336466D-02	1.261793D-02	7.002230D-01	2.643575D-01	9.152668D-03	1.327D 00	8.387D 01	1.476D 01
6	2.550006D-04	1.082000D-02	1.056952D-02	6.636246D-01	3.017902D-01	1.294066D-02	1.094D 00	8.196D 01	1.690D 01
7	2.426013D-04	9.302298D-03	9.032074D-03	6.240939D-01	3.393117D-01	1.801832D-02	9.405D-01	7.980D 01	1.921D 01
8	2.362025D-04	8.376713D-03	7.877618D-03	5.828246D-01	3.759598D-01	2.472508D-02	8.359D-01	7.746D 01	2.155D 01
9	2.319164D-04	7.789072D-03	7.006564D-03	5.408592D-01	4.106648D-01	3.346852D-02	7.626D-01	7.497D 01	2.422D 01
10	2.283652D-04	7.392712D-03	6.343081D-03	4.991093D-01	4.423105D-01	4.461609D-02	7.093D-01	7.236D 01	2.688D 01
11	2.250662D-04	7.104021D-03	5.830377D-03	4.583593D-01	4.698014D-01	5.867988D-02	6.689D-01	6.965D 01	2.964D 01
12	2.218522D-04	6.875857D-03	5.426477D-03	4.192548D-01	4.921276D-01	7.609332D-02	6.370D-01	6.685D 01	3.247D 01
13	2.186653D-04	6.681893D-03	5.100713D-03	3.822951D-01	5.084253D-01	9.727833D-02	6.108D-01	6.396D 01	3.539D 01
14	2.154845D-04	6.507544D-03	4.830916D-03	3.478328D-01	5.180300D-01	1.225833D-01	5.883D-01	6.099D 01	3.839D 01
15	2.123018D-04	6.344793D-03	4.601239D-03	3.160844D-01	5.205239D-01	1.522334D-01	5.684D-01	5.793D 01	4.147D 01
16	8.298456D-05	3.907344D-03	3.530427D-03	2.981948D-01	5.390520D-01	1.552324D-01	3.801D-01	5.695D 01	4.264D 01
17	3.226313D-05	2.391545D-03	2.690436D-03	2.790917D-01	5.572737D-01	1.585203D-01	2.572D-01	5.587D 01	4.384D 01
18	1.247983D-05	1.455281D-03	2.036922D-03	2.591829D-01	5.750683D-01	1.622441D-01	1.758D-01	5.473D 01	4.507D 01
19	4.803566D-06	8.805276D-04	1.532141D-03	2.388027D-01	5.922005D-01	1.665793D-01	1.211D-01	5.352D 01	4.633D 01
20	1.839874D-06	5.297455D-04	1.144821D-03	2.182383D-01	6.083371D-01	1.717482D-01	8.389D-02	5.225D 01	4.763D 01
21	7.012414D-07	3.168631D-04	8.495036D-04	1.977416D-01	6.230523D-01	1.780391D-01	5.837D-02	5.093D 01	4.898D 01
22	2.659250D-07	1.883884D-04	6.257181D-04	1.775350D-01	6.358252D-01	1.858254D-01	4.072D-02	4.954D 01	5.039D 01
23	1.003198D-07	1.112859D-04	4.571670D-04	1.578128D-01	6.460319D-01	1.955867D-01	2.842D-02	4.807D 01	5.187D 01
24	3.763814D-08	6.527454D-05	3.309876D-04	1.387421D-01	6.529338D-01	2.079278D-01	1.981D-02	4.651D 01	5.344D 01
25	1.403740D-08	3.797578D-05	2.371092D-04	1.204643D-01	6.556674D-01	2.235931D-01	1.375D-02	4.482D 01	5.514D 01
26	5.200307D-09	2.187687D-05	1.677072D-04	1.030982D-01	6.532420D-01	2.434702D-01	9.478D-03	4.296D 01	5.700D 01
27	1.910869D-09	1.244378D-05	1.167469D-04	8.674381D-02	6.445543D-01	2.685727D-01	6.458D-03	4.089D 01	5.908D 01
28	6.943305D-10	6.955334D-06	7.960692D-05	7.148785D-02	6.284350D-01	2.999906D-01	4.327D-03	3.856D 01	6.141D 01
29	2.476489D-10	3.787392D-06	5.277089D-05	5.740863D-02	6.037399D-02	3.387949D-01	2.827D-03	3.592D 01	6.406D 01
30	8.498651D-11	1.975912D-06	3.357868D-05	4.457942D-02	5.694978D-01	3.858872D-01	1.777D-03	3.293D 01	6.706D 01

Table 13. Effect of Operating Pressure

ISOTOPIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND PP LOCATION= 12 3RD PP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.463442D 01 2.471111D 01 2.476739D 01 2.481355D 01 2.485418D 01 2.489165D 01
 2.492732D 01 2.496200D 01 2.499618D 01 2.503015D 01 2.506409D 01 2.509813D 01
 2.513235D 01 2.516681D 01 2.520154D 01 2.522205D 01 2.524050D 01 2.525808D 01
 2.527543D 01 2.529298D 01 2.531108D 01 2.533001D 01 2.535009D 01 2.537162D 01
 2.539495D 01 2.542050D 01 2.544869D 01 2.548002D 01 2.551496D 01 2.555392D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 1.000010D 00 1.000010D 00 1.000010D 00 1.000010D 00 1.000010D 00 1.000010D 00
 1.000011D 00 1.000010D 00 1.000010D 00 1.000010D 00 1.000009D 00 1.000009D 00
 1.000008D 00 1.000007D 00 1.000006D 00 1.000006D 00 1.000007D 00 1.000007D 00
 1.000007D 00 1.000007D 00 1.000007D 00 1.000007D 00 1.000007D 00 1.000007D 00
 1.000007D 00 1.000006D 00 1.000006D 00 1.000006D 00 1.000005D 00 1.000005D 00

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666129D-03	8.996687D-02	3.642225D-02	7.103798D-01	1.528073D-01	3.767222D-03	6.986D 00	8.318D 01	9.838D 00
1	1.918818D-03	6.109948D-02	2.997418D-02	7.146544D-01	1.867606D-01	5.592578D-03	4.746D 00	8.386D 01	1.140D 01
2	6.291332D-04	4.193648D-02	2.451480D-02	7.041378D-01	2.208321D-01	7.949712D-03	3.385D 00	8.355D 01	1.306D 01
3	2.829710D-04	2.95678D-02	2.009492D-02	6.841218D-01	2.549715D-01	1.097207D-02	2.511D 00	8.264D 01	1.485D 01
4	1.901754D-04	2.168218D-02	1.660324D-02	6.578189D-01	2.888927D-01	1.481276D-02	1.933D 00	8.131D 01	1.676D 01
5	1.647339D-04	1.671702D-02	1.388618D-02	6.274088D-01	3.221773D-01	1.964592D-02	1.547D 00	7.968D 01	1.877D 01
6	1.570939D-04	1.359647D-02	1.179198D-02	5.944686D-01	3.543199D-01	2.566594D-02	1.285D 00	7.784D 01	2.087D 01
7	1.541577D-04	1.162961D-02	1.018669D-02	5.601855D-01	3.847592D-01	3.308480D-02	1.106D 00	7.584D 01	2.305D 01
8	1.524779D-04	1.037659D-02	8.958611D-03	5.254766D-01	4.129082D-01	4.212761D-02	9.820D-01	7.371D 01	2.531D 01
9	1.511456D-04	9.561383D-03	8.017754D-03	4.910594D-01	4.381843D-01	5.302599D-02	8.941D-01	7.149D 01	2.761D 01
10	1.499178D-04	9.012837D-03	7.293296D-03	4.574948D-01	4.600398D-01	6.600936D-02	8.303D-01	6.920D 01	2.997D 01
11	1.487275D-04	8.625875D-03	6.730473D-03	4.252130D-01	4.779881D-01	8.129382D-02	7.827D-01	6.685D 01	3.237D 01
12	1.475539D-04	8.336577D-03	6.287532D-03	3.945320D-01	4.916275D-01	9.906880D-02	7.460D-01	6.445D 01	3.480D 01
13	1.463898D-04	8.106368D-03	5.933021D-03	3.656722D-01	5.006604D-01	1.194817D-01	7.166D-01	6.201D 01	3.728D 01
14	1.452318D-04	7.912149D-03	5.643507D-03	3.387697D-01	5.049082D-01	1.426212D-01	6.923D-01	5.952D 01	3.979D 01
15	1.440782D-04	7.740201D-03	5.401718D-03	3.138905D-01	5.043224D-01	1.685010D-01	6.715D-01	5.699D 01	4.234D 01
16	4.287398D-05	5.237941D-03	4.385234D-03	3.014505D-01	5.174682D-01	1.714152D-01	4.854D-01	5.628D 01	4.323D 01
17	1.271759D-05	3.529122D-03	3.541942D-03	2.877925D-01	5.304539D-01	1.746698D-01	3.548D-01	5.548D 01	4.417D 01
18	3.760957D-06	2.367785D-03	2.846480D-03	2.731270D-01	5.432409D-01	1.784141D-01	2.611D-01	5.459D 01	4.515D 01
19	1.108900D-06	1.581917D-03	2.275804D-03	2.576213D-01	5.556992D-01	1.828207D-01	1.930D-01	5.363D 01	4.618D 01
20	3.259660D-07	1.052274D-03	1.809637D-03	2.414206D-01	5.676171D-01	1.881000D-01	1.431D-01	5.258D 01	4.728D 01
21	9.552096D-08	6.967210D-04	1.430467D-03	2.246583D-01	5.787012D-01	1.945132D-01	1.064D-01	5.144D 01	4.846D 01
22	2.790033D-08	4.589748D-04	1.123348D-03	2.074617D-01	5.885707D-01	2.023852D-01	7.912D-02	5.020D 01	4.972D 01
23	8.121187D-09	3.006409D-04	8.756354D-04	1.899563D-01	5.967502D-01	2.121172D-01	5.881D-02	4.885D 01	5.109D 01
24	2.355146D-09	1.956340D-04	6.767047D-04	1.722674D-01	6.026620D-01	2.241982D-01	4.362D-02	4.737D 01	5.259D 01
25	6.802321D-10	1.263006D-04	5.176793D-04	1.545225D-01	6.056212D-01	2.392123D-01	3.220D-02	4.574D 01	5.423D 01
26	1.955802D-10	8.073829D-05	3.911809D-04	1.368530D-01	6.048366D-01	2.578384D-01	2.360D-02	4.393D 01	5.604D 01
27	5.593099D-11	5.095230D-05	2.911054D-04	1.193966D-01	5.994231D-01	2.808382D-01	1.710D-02	4.191D 01	5.807D 01
28	1.587816D-11	3.159296D-05	2.124246D-04	1.022991D-01	5.884317D-01	3.090251D-01	1.220D-02	3.965D 01	6.033D 01
29	4.449672D-12	1.909415D-05	1.510130D-04	8.571655D-02	5.709038D-01	3.432095D-01	8.505D-03	3.712D 01	6.287D 01
30	1.207618D-12	1.108794D-05	1.034962D-04	6.981538D-02	5.459556D-01	3.841145D-01	5.729D-03	3.428D 01	6.571D 01

Table 14. Effect of Operating Pressure

ISOTOPIIC SEPARATION AT PT= 1.500D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND FP LOCATION= 12 3RD FP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.627257D 01 2.634425D 01 2.640111D 01 2.644841D 01 2.648960D 01 2.652685D 01
 2.656159D 01 2.659472D 01 2.662681D 01 2.665823D 01 2.668922D 01 2.671995D 01
 2.675052D 01 2.678099D 01 2.681141D 01 2.682943D 01 2.684599D 01 2.686183D 01
 2.687749D 01 2.689339D 01 2.690989D 01 2.692730D 01 2.694592D 01 2.696607D 01
 2.698808D 01 2.701232D 01 2.703917D 01 2.706903D 01 2.710230D 01 2.713933D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 9.999959D-01 9.999960D-01 9.999960D-01 9.999960D-01 9.999960D-01 9.999960D-01
 9.999961D-01 9.999962D-01 9.999963D-01 9.999965D-01 9.999967D-01 9.999970D-01
 9.999972D-01 9.999976D-01 9.999979D-01 9.999978D-01 9.999977D-01 9.999976D-01
 9.999975D-01 9.999974D-01 9.999974D-01 9.999974D-01 9.999974D-01 9.999974D-01
 9.999974D-01 9.999975D-01 9.999976D-01 9.999977D-01 9.999979D-01 9.999980D-01

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666847D-03	8.993839D-02	3.622720D-02	6.705535D-01	1.893902D-01	7.219742D-03	6.975D 00	8.102D 01	1.200D 01
1	3.258143D-03	6.290812D-02	3.009365D-02	6.693171D-01	2.242731D-01	1.014989D-02	4.976D 00	8.129D 01	1.373D 01
2	1.673004D-03	4.448503D-02	2.490649D-02	6.568752D-01	2.583108D-01	1.374942D-02	3.637D 00	8.083D 01	1.554D 01
3	9.463258D-04	3.219247D-02	2.066388D-02	6.368059D-01	2.912593D-01	1.813210D-02	2.737D 00	7.985D 01	1.741D 01
4	6.159298D-04	2.410610D-02	1.726923D-02	6.117287D-01	3.228553D-01	2.342472D-02	2.130D 00	7.852D 01	1.935D 01
5	4.659111D-04	1.883408D-02	1.459290D-02	5.835429D-01	3.528001D-01	2.976415D-02	1.718D 00	7.694D 01	2.135D 01
6	3.971519D-04	1.541179D-02	1.250353D-02	5.536295D-01	3.807639D-01	3.729408D-02	1.435D 00	7.517D 01	2.339D 01
7	3.647253D-04	1.318912D-02	1.088229D-02	5.230017D-01	4.064010D-01	4.616113D-02	1.240D 00	7.328D 01	2.548D 01
8	3.484636D-04	1.173639D-02	9.627957D-03	4.924084D-01	4.293685D-01	5.651024D-02	1.103D 00	7.130D 01	2.760D 01
9	3.393807D-04	1.077370D-02	8.657426D-03	4.624045D-01	4.493456D-01	6.847937D-02	1.005D 00	6.925D 01	2.975D 01
10	3.334956D-04	1.012089D-02	7.904129D-03	4.333978D-01	4.660503D-01	8.219340D-02	9.346D-01	6.715D 01	3.192D 01
11	3.290510D-04	9.663074D-03	7.315723D-03	4.056807D-01	4.792541D-01	9.775738D-02	8.818D-01	6.501D 01	3.410D 01
12	3.252727D-04	9.327616D-03	6.851628D-03	3.794539D-01	4.887924D-01	1.152492D-01	8.415D-01	6.285D 01	3.631D 01
13	3.218186D-04	9.068939D-03	6.480764D-03	3.548431D-01	4.945732D-01	1.347122D-01	8.097D-01	6.067D 01	3.852D 01
14	3.185371D-04	8.858639D-03	6.179568D-03	3.319141D-01	4.965813D-01	1.561479D-01	7.838D-01	5.846D 01	4.075D 01
15	3.153607D-04	8.679141D-03	5.930355D-03	3.106846D-01	4.948809D-01	1.795096D-01	7.620D-01	5.625D 01	4.299D 01
16	1.587734D-04	6.172007D-03	4.961278D-03	3.008481D-01	5.054603D-01	1.823995D-01	5.725D-01	5.567D 01	4.376D 01
17	7.968836D-05	4.373131D-03	4.132155D-03	2.898679D-01	5.159060D-01	1.856465D-01	4.332D-01	5.500D 01	4.457D 01
18	3.987660D-05	3.087536D-03	3.426267D-03	2.778741D-01	5.261799D-01	1.893923D-01	3.297D-01	5.425D 01	4.542D 01
19	1.989576D-05	2.171995D-03	2.827785D-03	2.649684D-01	5.362102D-01	1.938018D-01	2.520D-01	5.342D 01	4.633D 01
20	9.896890D-06	1.522121D-03	2.322227D-03	2.512361D-01	5.458372D-01	1.990724D-01	1.932D-01	5.249D 01	4.732D 01
21	4.907681D-06	1.062279D-03	1.896615D-03	2.367541D-01	5.548378D-01	2.054443D-01	1.484D-01	5.147D 01	4.838D 01
22	2.425502D-06	7.379248D-04	1.539488D-03	2.215959D-01	5.629140D-01	2.132102D-01	1.141D-01	5.034D 01	4.954D 01
23	1.194370D-06	5.098736D-04	1.240817D-03	2.058372D-01	5.696862D-01	2.227247D-01	8.765D-02	4.909D 01	5.082D 01
24	5.857146D-07	3.500723D-04	9.918929D-04	1.895582D-01	5.746864D-01	2.344128D-01	6.716D-02	4.771D 01	5.223D 01
25	2.858456D-07	2.384983D-04	7.851923D-04	1.728478D-01	5.773531D-01	2.487751D-01	5.121D-02	4.616D 01	5.378D 01
26	1.386626D-07	1.609020D-04	6.142483D-04	1.558064D-01	5.770308D-01	2.663876D-01	3.877D-02	4.444D 01	5.552D 01
27	6.671962D-08	1.071714D-04	4.735226D-04	1.385490D-01	5.729777D-01	2.878926D-01	2.964D-02	4.251D 01	5.746D 01
28	3.171516D-08	7.015022D-05	3.582878D-04	1.212085D-01	5.643853D-01	3.139777D-01	2.143D-02	4.034D 01	5.964D 01
29	1.477161D-08	4.478868D-05	2.645192D-04	1.039381D-01	5.504153D-01	3.453373D-01	1.547D-02	3.792D 01	6.207D 01
30	6.619140D-09	2.753310D-05	1.887950D-04	8.691281D-02	5.302561D-01	3.826147D-01	1.082D-02	3.521D 01	6.478D 01

Table 15. Effect of Operating Pressure

ISOTOPIIC SEPARATION AT PT= 2.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND FP LOCATION= 12 3RD FP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.754899D 01 2.761994D 01 2.767668D 01 2.772391D 01 2.776480D 01 2.780145D 01
 2.783524D 01 2.786708D 01 2.789759D 01 2.792717D 01 2.795608D 01 2.798451D 01
 2.801257D 01 2.804034D 01 2.806786D 01 2.808448D 01 2.809981D 01 2.811451D 01
 2.812906D 01 2.814387D 01 2.815928D 01 2.817559D 01 2.819312D 01 2.821217D 01
 2.823307D 01 2.825616D 01 2.828179D 01 2.831035D 01 2.834220D 01 2.837767D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 9.999987D-01 9.999987D-01 9.999988D-01 9.999988D-01 9.999988D-01 9.999988D-01
 9.999989D-01 9.999989D-01 9.999989D-01 9.999990D-01 9.999991D-01 9.999991D-01
 9.999992D-01 9.999993D-01 9.999994D-01 9.999994D-01 9.999993D-01 9.999993D-01
 9.999993D-01 9.999993D-01 9.999992D-01 9.999992D-01 9.999992D-01 9.999992D-01
 9.999992D-01 9.999992D-01 9.999993D-01 9.999993D-01 9.999993D-01 9.999994D-01

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666680D-03	8.988335D-02	3.601037D-02	6.410251D-01	2.154580D-01	1.095526D-02	6.961D 00	7.937D 01	1.367D 01
1	3.420388D-03	6.415974D-02	3.014099D-02	6.372923D-01	2.501161D-01	1.487051D-02	5.057D 00	7.944D 01	1.550D 01
2	1.835295D-03	4.628014D-02	2.515703D-02	6.240449D-01	2.831668D-01	1.951581D-02	3.755D 00	7.888D 01	1.737D 01
3	1.071589D-03	3.409478D-02	2.105232D-02	6.043652D-01	3.144322D-01	2.498390D-02	2.865D 00	7.786D 01	1.927D 01
4	7.065976D-04	2.590120D-02	1.774068D-02	5.805369D-01	3.437399D-01	3.137470D-02	2.253D 00	7.654D 01	2.121D 01
5	5.325693D-04	2.043983D-02	1.510642D-02	5.542252D-01	3.709043D-01	3.879176D-02	1.831D 00	7.499D 01	2.318D 01
6	4.490998D-04	1.681673D-02	1.303103D-02	5.266380D-01	3.957264D-01	4.733872D-02	1.537D 00	7.329D 01	2.517D 01
7	4.082649D-04	1.441462D-02	1.140606D-02	4.986515D-01	4.180038D-01	5.711579D-02	1.332D 00	7.149D 01	2.718D 01
8	3.874051D-04	1.281544D-02	1.013794D-02	4.709002D-01	4.375430D-01	6.821605D-02	1.186D 00	6.961D 01	2.921D 01
9	3.758847D-04	1.174010D-02	9.148937D-03	4.438413D-01	4.541723D-01	8.072153D-02	1.082D 00	6.768D 01	3.124D 01
10	3.687390D-04	1.100441D-02	8.376051D-03	4.177991D-01	4.677524D-01	9.469926D-02	1.006D 00	6.572D 01	3.328D 01
11	3.636597D-04	1.048791D-02	7.769153D-03	3.929966D-01	4.781856D-01	1.101971D-01	9.492D-01	6.373D 01	3.532D 01
12	3.595758D-04	1.011248D-02	7.288919D-03	3.695780D-01	4.854212D-01	1.272395D-01	9.060D-01	6.173D 01	3.736D 01
13	3.559900D-04	9.827778D-03	6.904857D-03	3.476263D-01	4.894599D-01	1.458251D-01	8.722D-01	5.973D 01	3.940D 01
14	3.526710D-04	9.601604D-03	6.593561D-03	3.271766D-01	4.903549D-01	1.659206D-01	8.450D-01	5.772D 01	4.144D 01
15	3.495107D-04	9.413464D-03	6.337222D-03	3.082269D-01	4.882117D-01	1.874611D-01	8.225D-01	5.570D 01	4.347D 01
16	1.867579D-04	6.918158D-03	5.408146D-03	2.999357D-01	4.972322D-01	1.903190D-01	6.350D-01	5.520D 01	4.416D 01
17	9.952323D-05	5.067847D-03	4.596368D-03	2.905742D-01	5.061225D-01	1.935395D-01	4.932D-01	5.462D 01	4.489D 01
18	5.289861D-05	3.700526D-03	3.890168D-03	2.802300D-01	5.148689D-01	1.972575D-01	3.848D-01	5.395D 01	4.566D 01
19	2.804437D-05	2.693192D-03	3.278045D-03	2.689684D-01	5.234028D-01	2.016295D-01	3.014D-01	5.320D 01	4.650D 01
20	1.482867D-05	1.953151D-03	2.749148D-03	2.568408D-01	5.316006D-01	2.068415D-01	2.366D-01	5.236D 01	4.740D 01
21	7.819050D-06	1.410940D-03	2.293491D-03	2.438912D-01	5.392793D-01	2.131172D-01	1.860D-01	5.142D 01	4.839D 01
22	4.110583D-06	1.014737D-03	1.902025D-03	2.301614D-01	5.461918D-01	2.207259D-01	1.462D-01	5.038D 01	4.948D 01
23	2.153790D-06	7.260131D-04	1.566642D-03	2.156948D-01	5.520194D-01	2.299910D-01	1.148D-01	4.921D 01	5.068D 01
24	1.124169D-06	5.162149D-04	1.280143D-03	2.005401D-01	5.563660D-01	2.412964D-01	8.993D-02	4.790D 01	5.201D 01
25	5.840375D-07	3.642358D-04	1.036167D-03	1.847558D-01	5.587523D-01	2.509090D-01	7.008D-02	4.643D 01	5.350D 01
26	3.016195D-07	2.545131D-04	8.291248D-04	1.684131D-01	5.586142D-01	2.718887D-01	5.421D-02	4.478D 01	5.516D 01
27	1.544874D-07	1.755981D-04	6.541266D-04	1.516004D-01	5.553072D-01	2.922625D-01	4.150D-02	4.293D 01	5.702D 01
28	7.814643D-08	1.190875D-04	5.069039D-04	1.344271D-01	5.481191D-01	3.168277D-01	3.131D-02	4.085D 01	5.911D 01
29	3.871864D-08	7.882683D-05	3.837430D-04	1.170273D-01	5.362968D-01	3.462133D-01	2.313D-02	3.852D 01	6.146D 01
30	1.846409D-08	5.031806D-05	2.814015D-04	9.956260D-02	5.190880D-01	3.810176D-01	1.659D-02	3.591D 01	6.407D 01

Table 16. Effect of Operating Pressure

ISOTOPIIC SEPARATION AT PT= 2.500D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND FP LOCATION= 12 3RD FP LOCATION= 15
 FEED RATES: 0.0 0.0 1.00D 02 PRODUCTS: 3.00D 01 0.0 BOTTOMS: 7.00D 01

FEED COMP. N-H2 HD HT N-D2 DT N-T2 APH APD APT
 2.000000D-03 2.700000D-02 1.100000D-02 2.620000D-01 4.280000D-01 2.700000D-01 2.100D 00 4.895D 01 4.895D 01

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 2.861130D 01 2.868126D 01 2.873753D 01 2.878843D 01 2.882489D 01 2.886094D 01
 2.889393D 01 2.892477D 01 2.895409D 01 2.898230D 01 2.900969D 01 2.903645D 01
 2.906272D 01 2.908856D 01 2.911405D 01 2.912968D 01 2.914417D 01 2.915808D 01
 2.917187D 01 2.918593D 01 2.920056D 01 2.921609D 01 2.923281D 01 2.925103D 01
 2.927105D 01 2.929323D 01 2.931790D 01 2.934542D 01 2.937615D 01 2.941042D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)
 9.999996D-01 9.999996D-01 9.999996D-01 9.999996D-01 9.999996D-01 9.999996D-01
 9.999997D-01 9.999997D-01 9.999997D-01 9.999997D-01 9.999997D-01 9.999997D-01
 9.999998D-01 9.999998D-01 9.999998D-01 9.999998D-01 9.999998D-01 9.999998D-01
 9.999998D-01 9.999998D-01 9.999998D-01 9.999998D-01 9.999998D-01 9.999998D-01
 9.999998D-01 9.999998D-01 9.999998D-01 9.999998D-01 9.999998D-01 9.999998D-01

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	6.666591D-03	8.981702D-02	3.578689D-02	6.182815D-01	2.348239D-01	1.462364D-02	6.947D 00	7.806D 01	1.499D 01
1	3.546679D-03	6.510465D-02	3.013903D-02	6.130815D-01	2.687669D-01	1.936124D-02	5.117D 00	7.800D 01	1.688D 01
2	1.966944D-03	4.767519D-02	2.532726D-02	5.995646D-01	3.006185D-01	2.484751D-02	3.847D 00	7.737D 01	1.878D 01
3	1.177065D-03	3.560658D-02	2.134255D-02	5.804510D-01	3.302672D-01	3.11557D-02	2.965D 00	7.634D 01	2.070D 01
4	7.852209D-04	2.735624D-02	1.810638D-02	5.577710D-01	3.576185D-01	3.836264D-02	2.352D 00	7.503D 01	2.262D 01
5	5.913971D-04	2.176405D-02	1.551354D-02	5.330110D-01	3.825736D-01	4.654633D-02	1.923D 00	7.352D 01	2.456D 01
6	4.951491D-04	1.799200D-02	1.34553D-02	5.072487D-01	4.050273D-01	5.578128D-02	1.622D 00	7.188D 01	2.650D 01
7	4.466447D-04	1.545090D-02	1.183210D-02	4.812607D-01	4.248735D-01	6.613616D-02	1.409D 00	7.014D 01	2.845D 01
8	4.213897D-04	1.373426D-02	1.055598D-02	4.556033D-01	4.420143D-01	7.767072D-02	1.257D 00	6.835D 01	3.040D 01
9	4.074299D-04	1.256568D-02	9.553937D-03	4.306704D-01	4.563695D-01	9.043303D-02	1.147D 00	6.651D 01	3.234D 01
10	3.989634D-04	1.175922D-02	8.766094D-03	4.067352D-01	4.678838D-01	1.044568D-01	1.066D 00	6.466D 01	3.428D 01
11	3.931852D-04	1.119097D-02	8.144335D-03	3.839798D-01	4.765329D-01	1.197588D-01	1.006D 00	6.278D 01	3.621D 01
12	3.887425D-04	1.077898D-02	7.650553D-03	3.625172D-01	4.823278D-01	1.363367D-01	9.604D-01	6.091D 01	3.813D 01
13	3.849831D-04	1.046940D-02	7.254908D-03	3.424073D-01	4.853164D-01	1.541669D-01	9.247D-01	5.903D 01	4.005D 01
14	3.815923D-04	1.022707D-02	6.934257D-03	3.236697D-01	4.855840D-01	1.732533D-01	8.962D-01	5.716D 01	4.195D 01
15	3.784174D-04	1.002913D-02	6.670805D-03	3.062932D-01	4.832523D-01	1.933376D-01	8.728D-01	5.529D 01	4.383D 01
16	2.113280D-04	7.552273D-03	5.776262D-03	2.990326D-01	4.912297D-01	1.961978D-01	6.876D-01	5.484D 01	4.447D 01
17	1.177306D-04	5.670089D-03	4.982173D-03	2.907637D-01	4.990833D-01	1.993830D-01	5.444D-01	5.431D 01	4.514D 01
18	6.543439D-05	4.244216D-03	4.280062D-03	2.815477D-01	5.068021D-01	2.030605D-01	4.328D-01	5.371D 01	4.586D 01
19	3.628357D-05	3.166972D-03	3.661324D-03	2.714271D-01	5.143288D-01	2.073796D-01	3.450D-01	5.302D 01	4.664D 01
20	2.007111D-05	2.355154D-03	3.117620D-03	2.604322D-01	5.215583D-01	2.125157D-01	2.756D-01	5.224D 01	4.749D 01
21	1.107457D-05	1.744824D-03	2.641088D-03	2.485867D-01	5.283336D-01	2.186827D-01	2.204D-01	5.136D 01	4.842D 01
22	6.093582D-06	1.287055D-03	2.224461D-03	2.359113D-01	5.344409D-01	2.261302D-01	1.762D-01	5.038D 01	4.945D 01
23	3.342345D-06	9.445366D-04	1.861100D-03	2.224281D-01	5.396029D-01	2.351600D-01	1.406D-01	4.927D 01	5.059D 01
24	1.826510D-06	6.888995D-04	1.545003D-03	2.081639D-01	5.434726D-01	2.461278D-01	1.119D-01	4.802D 01	5.186D 01
25	9.935912D-07	4.986237D-04	1.270780D-03	1.931544D-01	5.456277D-01	2.594475D-01	8.857D-02	4.662D 01	5.329D 01
26	5.372708D-07	3.574223D-04	1.033620D-03	1.774478D-01	5.455682D-01	2.755925D-01	6.961D-02	4.504D 01	5.489D 01
27	2.880896D-07	2.529935D-04	8.292441D-04	1.611094D-01	5.427179D-01	2.950902D-01	5.414D-02	4.326D 01	5.669D 01
28	1.525200D-07	1.760632D-04	6.538648D-04	1.442263D-01	5.364338D-01	3.185098D-01	4.151D-02	4.125D 01	5.871D 01
29	7.907110D-08	1.196523D-04	5.041322D-04	1.269117D-01	5.260258D-01	3.464387D-01	3.120D-02	3.900D 01	6.097D 01
30	3.947249D-08	7.851774D-05	3.770867D-04	1.093084D-01	5.107894D-01	3.794466D-01	2.278D-02	3.647D 01	6.350D 01

Table 17. Analytical Results for Multifeed Columns

ISOTOPIC SEPARATION AT PT= 1.000D 03 TORR, AFTER NUMBER OF ITERATIONS= 15
 NUMBER OF THEORETICAL STAGES= 30 REFLUX RATIO L/D1= 1.500D 01
 SIDE STREAM LOCATION= 6 1ST FEED PLATE LOCATION= 10 2ND PP LOCATION= 12 3RD PP LOCATION= 15
 FEED RATES: 1.50D 00 8.85D 01 1.00D 01 PRODUCTS: 1.80D 01 0.0 BOTTOMS: 8.20D 01

FEED COMP. N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1.000000D-04	5.000000D-03	5.000000D-03	2.500000D-01	4.899000D-01	2.500000D-01	3.755D 00	8.887D 01	7.379D 00
8.000000D-03	3.198990D-02	3.194160D-02	9.207500D-01	7.326180D-03	6.510520D-08	3.755D 00	8.887D 01	7.379D 00
2.000000D-03	2.700000D-02	1.100000D-02	2.620000D-01	4.280000D-01	2.700000D-01	3.755D 00	8.887D 01	7.379D 00

EQUILIBRIUM STAGE TEMPERATURES, DEG.K.. (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)

2.424160D 01	2.438097D 01	2.445305D 01	2.449680D 01	2.452618D 01	2.454708D 01
2.456256D 01	2.457454D 01	2.458433D 01	2.459292D 01	2.459651D 01	2.459919D 01
2.461615D 01	2.463272D 01	2.465387D 01	2.465880D 01	2.466304D 01	2.466684D 01
2.467032D 01	2.467357D 01	2.467655D 01	2.467966D 01	2.468269D 01	2.468589D 01
2.468949D 01	2.469383D 01	2.469951D 01	2.470750D 01	2.471946D 01	2.473817D 01

SUMMATION OF LIQUID MOLE FRACTIONS..... (FROM L TO R IN ASCENDING ORDER OF PLATE NUMBER)

1.000000D 00					
1.000000D 00					
1.000000D 00					
1.000000D 00					
1.000000D 00					

PLATE NO.	N-H2	HD	HT	N-D2	DT	N-T2	APH	APD	APT
1	4.045249D-02	1.695094D-01	1.165419D-01	6.708856D-01	2.516199D-03	9.443035D-05	1.835D 01	7.569D 01	5.962D 00
1	1.249230D-02	1.267721D-01	1.062158D-01	7.509188D-01	3.443055D-03	1.578962D-04	1.290D 01	8.160D 01	5.499D 00
2	4.288508D-03	9.352417D-02	9.389763D-02	8.035947D-01	4.448369D-03	2.466451D-04	9.800D 00	8.526D 01	4.942D 00
3	1.946941D-03	6.975669D-02	8.219412D-02	8.401605D-01	5.570041D-03	3.717446D-04	7.792D 00	8.778D 01	4.425D 00
4	1.284225D-03	5.336576D-02	7.191250D-02	8.660520D-01	6.837205D-03	5.483105D-04	6.392D 00	8.962D 01	3.992D 00
5	1.095197D-03	4.227012D-02	6.321220D-02	8.843478D-01	8.277352D-03	7.973178D-04	5.384D 00	9.096D 01	3.654D 00
6	1.039319D-03	3.483939D-02	5.600757D-02	8.970459D-01	9.919769D-03	1.148066D-03	4.646D 00	9.194D 01	3.411D 00
7	1.021184D-03	2.989395D-02	5.012250D-02	9.055240D-01	1.179682D-02	1.641510D-03	4.103D 00	9.264D 01	3.260D 00
8	1.014064D-03	2.661216D-02	4.535740D-02	9.107373D-01	1.394429D-02	2.334790D-03	3.700D 00	9.310D 01	3.199D 00
9	1.010361D-03	2.443387D-02	4.151936D-02	9.133277D-01	1.640136D-02	3.307389D-03	3.399D 00	9.337D 01	3.227D 00
10	1.007814D-03	2.298205D-02	3.843503D-02	9.136956D-01	1.921010D-02	4.669425D-03	3.172D 00	9.348D 01	3.349D 00
11	1.007849D-03	2.209331D-02	3.614140D-02	9.166793D-01	1.941499D-02	4.663142D-03	3.013D 00	9.374D 01	3.244D 00
12	1.007379D-03	2.150508D-02	3.432096D-02	9.188774D-01	1.963868D-02	4.650523D-03	2.892D 00	9.394D 01	3.163D 00
13	3.836968D-04	1.884073D-02	3.335758D-02	9.162239D-01	2.445175D-02	6.742354D-03	2.648D 00	9.379D 01	3.565D 00
14	1.580949D-04	1.650245D-02	3.222473D-02	9.088288D-01	3.169392D-02	1.059284D-02	2.452D 00	9.329D 01	4.255D 00
15	7.660879D-05	1.444251D-02	3.089122D-02	8.944510D-01	4.250837D-02	1.763030D-02	2.274D 00	9.229D 01	5.433D 00
16	2.820804D-05	1.239247D-02	3.005390D-02	8.972602D-01	4.261062D-02	1.765462D-02	2.125D 00	9.248D 01	5.399D 00
17	1.037868D-05	1.060344D-02	2.914247D-02	8.998466D-01	4.271877D-02	1.767831D-02	1.988D 00	9.265D 01	5.361D 00
18	3.816084D-06	9.044957D-03	2.815851D-02	9.022484D-01	4.284120D-02	1.770308D-02	1.861D 00	9.282D 01	5.320D 00
19	1.402251D-06	7.689330D-03	2.710267D-02	9.044857D-01	4.298942D-02	1.773151D-02	1.740D 00	9.298D 01	5.278D 00
20	5.149718D-07	6.511659D-03	2.597501D-02	9.065646D-01	4.318021D-02	1.776800D-02	1.624D 00	9.314D 01	5.235D 00
21	1.890173D-07	5.439725D-03	2.477512D-02	9.084759D-01	4.343865D-02	1.782043D-02	1.513D 00	9.329D 01	5.193D 00
22	6.933973D-08	4.603756D-03	2.350206D-02	9.101884D-01	4.380245D-02	1.790318D-02	1.405D 00	9.344D 01	5.156D 00
23	2.542216D-08	3.836421D-03	2.215440D-02	9.116380D-01	4.432848D-02	1.804263D-02	1.300D 00	9.357D 01	5.128D 00
24	9.314288D-09	3.172194D-03	2.073006D-02	9.127079D-01	4.510248D-02	1.828738D-02	1.195D 00	9.368D 01	5.120D 00
25	3.409434D-09	2.597563D-03	1.922615D-02	9.131959D-01	4.625331D-02	1.872706D-02	1.091D 00	9.376D 01	5.147D 00
26	1.246036D-09	2.100620D-03	1.763874D-02	9.127602D-01	4.797361D-02	1.952679D-02	9.870D-01	9.378D 01	5.233D 00
27	4.539225D-10	1.670925D-03	1.596256D-02	9.108277D-01	5.054889D-02	2.098992D-02	8.817D-01	9.369D 01	5.425D 00
28	1.641214D-10	1.299360D-03	1.419066D-02	9.064429D-01	5.439631D-02	2.369706D-02	7.745D-01	9.343D 01	5.796D 00
29	5.820672D-11	9.780184D-04	1.231433D-02	8.980240D-01	6.011137D-02	2.857231D-02	6.646D-01	9.286D 01	6.479D 00
30	1.955957D-11	7.001848D-04	1.032386D-02	8.829861D-01	6.851082D-02	3.747969D-02	5.512D-01	9.176D 01	7.690D 00

APPENDIX
Fortran Listings

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C      PROGRAM TO CALCULATE NUMBER OF THEORETICAL PLATES FOR H2-ISOTOPES
C      MULTICOMPONENT ISOTOPIC SEPARATION RECIRCULATION ANALYSIS
C      IMPLICIT REAL*8 (A-H,O-Z)
C      DIMENSION APHF(3), APDF(3), APTF(3), APH(50), APD(50), APT(50),
1T(50), V(50), X(50,6), XF1(6), XF2(6), XF3(6), Y(50,6), XC(50,6),
2PHITP(50), A2(6), B2(6), A3(6), B3(6), TITLE(9)
C      DIMENSION C1(6), C2(6), C3(6), C4(6), C5(6), CX1(5,6), CX2(5,6),
1CX3(5,6), CX4(5,6), CX5(5,6), PT(5), VT(20), VP(20,6)
C      COMMON/MISRA4/CX1, CX2, CX3, CX4, CX5, PT, VT, VP, NM1, M1, N1,
1NP1, IP, NC1, NR1
C      COMMON/MISRA3/APH, APD, APT, APHY, APDY, APTY, C1, C2, C3, C4, C5,
1TB, TD, PHITP, VO
C      COMMON/MISRA2/NP, M, INPUT, NF1, NF2, NF3, NS, NC, NTRL, NR,
1IFRNT, ITR, T, XC, Y, D1, D2, XF1, XF2, XF3, F1, F2, F3, V, W,
2QC, QW
C      ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
C      ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
C      **          SIMPLIFYING ASSUMPTIONS          **
C      ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
C      MULTIPLE FEED AND SIDE STREAM WITHDRAWAL
C      ASSUMES FEED AND SIDE STREAMS ARE SATURATED LIQUID
C      ADIABATIC OPERATION
C      MOLAR HEATS OF VAPORIZATION IS THE SAME FOR ALL COMPONENTS
C      ISOTOPES OF HYDROGEN FORM IDEAL MIXTURES
C      EQUILIBRIUM CONSTANTS ARE BASED ON VAPOR PRESSURE DATA
C      DISTILLATION COLUMN IS ASSUMED TO HAVE PARTIAL CONDENSER
C      NUMBERING OF THEORETICAL STAGES STARTS FROM TOP OF THE COLUMN
C      ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
C      ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
C      **          NOMENCLATURE          **
C      ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
C      A....NP X NP COEFFICIENT MATRIX
C      A(J,K)....MEMBERS OF MATRIX A
C      B....NP X 1 CONSTANT VECTORS
C      C1(I), C2(I),.....CN(I) POLYNOMIAL FITTING COEFFICIENTS
C      D1...TOP PRODUCT OR DISTILLATE FLOW RATE, MOLES/UNIT TIME
C      D2.... SIDE STREAM WITHDRAWL RATE, MOLES/UNIT TIME
C      F1, F2, F3....FLOW RATES OF FEEDS, MOLES/UNIT TIME
C      I....COMPONENT I
C      J....PLATE OR THEORETICAL STAGE NUMBER
C      L.....LIQUID FLOW RATE, MOLES/UNIT TIME
C      L/D....REFLUX RATIO
C      NF1, NF2, NF3.....FEED PLATE LOCATIONS AT WHICH FEEDS F1, F2, AND
C      F3 RESPECTIVELY ENTER
C      NC....NUMBER OF COMPONENTS IN THE FEED MIXTURE
C      NS....SIDE STREAM WITHDRAWL LOCATION
C      NP....NUMBER OF THEORETICAL STAGES OR PLATES
C      PT.....COLUMN OPERATING PRESSURE, TORR
C      RK....CHEMICAL EQUILIBRIUM CONSTANT
C      TE....TEMPERATURE OF CHEMICAL EQUILIBRATOR, DEG. KELVIN
C      TB....TEMPERATURE CORRESPONDING TO THE BOTTOM PLATE, DEG. KELVIN
C      TD....TEMPERATURE OF THE TOP PLATE, DEG. KELVIN
C      T(J)....TEMPERATURE OF THE LIQUID ON PLATE J
C      VO, ...VAPOR FLOW RATE, MOLES/UNIT TIME
C      V(J)....VAPOR FLOW RATE AT PLATE J
C      VT(L)....SATURATION TEMPERATURE OF VAPOR, DEG. KELVIN
C      VP(L,K)....VAPOR PRESSURE OF COMPONENT K AT TEMPERATURE VT(L),TORR
C      W.... BOTTOM PRODUCT FLOW RATE, MOLES/UNIT TIME
C      X....NP X 1 SOLUTION VECTORS

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C      XD2....EXCESS DEUTERIUM ADDITION TO CHEMICAL EQUILIBRATOR
C      XK(J,I)....PHASE EQUILIBRIUM CONSTANT OF COMPONENT I ON PLATE J
C      Y(J,I)....MOLE FRACTION OF COMPONENT I IN VAPOR PHASE ON PLATE J
C      ****      ****      ****      ****      ****      ****      ****      ****      **
C      READ INPUT DATA
C      READ 1100, TITLE
5     READ 1000, NP, M, INPUT, NF1, NF2, NF3, NC, NS, NTRL, NR, IPRNT
      IF (M.LE.0) GO TO 900
      READ 1000, NM1, M1, N1, IP, NP1, NC1, NR1, KEQ, NPR, KOEF
      READ 2050, D1, D2, F1, F2, F3, TB, TD, VO, W
      READ 2000, ( PT(L), L = 1, NR1 )
      READ 2000, ( XF1(I), I = 1, NC )
      READ 2000, ( XF2(I), I = 1, NC )
      READ 2000, ( XF3(I), I = 1, NC )
      IF ( KOEF .LE. 0 ) GC TO 10
      READ 1650, (( C1(I), C2(I), C3(I), C4(I), C5(I) ), I = 1, NC )
      GC TO 25
10    CONTINUE
      READ 2000, ( VT(I), I = 1, NP1 )
      DO 15 K = 1, NC
      READ 2000, ( VP(I,K) , I = 1, NP1 )
15    CONTINUE
      CALL FOLYFT
      DO 20 L = NPR, NPR
      DO 20 K = 1, NC
      C1(K) = CX1(L,K)
      C2(K) = CX2(L,K)
      C3(K) = CX3(L,K)
      C4(K) = CX4(L,K)
      C5(K) = CX5(L,K)
20    CONTINUE
25    IF ( INPUT .LE. 0 ) GO TO 40
C     PRINT INPUT DATA
      PRINT 1100, TITLE
      PRINT 1000, NP, M, INPUT, NF1, NF2, NF3, NC, NS, NTRL, NR, IPRNT
      PRINT 1000, NM1, M1, N1, IP, NP1, NC1, NR1, KEQ, NPR, KOEF
      PRINT 4500, D1, D2, F1, F2, F3, TB, TD, VO, W
      PRINT 4500, ( PT(L), L = 1, NR1 )
      PRINT 1200
      PRINT 4500, ( XF1(I), I = 1, NC )
      PRINT 4500, ( XF2(I), I = 1, NC )
      PRINT 4500, ( XF3(I), I = 1, NC )
      IF ( KOEF .GT. 0 ) GC TO 35
      PRINT 2025
      DO 30 I = 1, NP1
30    PRINT 1675, VT(I), ( VP(I,K), K = 1, NC )
35    CONTINUE
      PRINT 1300, PT(NPR)
      PRINT 4100, ((C1(I), C2(I), C3(I), C4(I), C5(I) ), I = 1, NC )
40    CONTINUE
      QC = 200.0D00 * D1
      QW = 200.0D00 * W
      ICASE = 0
70    CCNTINUE
      IF ( ICASE .LE. 0 ) GO TO 80
      READ 1100, TITLE
      READ 1000, NP, M, INPUT, NF1, NF2, NF3, NC, NS, NTRL, NR, IPRNT
      IF (M.LE.0) GO TO 900
      READ 2050, D1, D2, F1, F2, F3, TB, TD, VO, W
      PRINT 1100, TITLE
      PRINT 1000, NP, M, INPUT, NF1, NF2, NF3, NC, NS, NTRL, NR, IPRNT
      PRINT 4500, D1, D2, F1, F2, F3, TB, TD, VO, W

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80 CCNTINUE
  ICASE = 1
  NFO = 1
  L9 = NP - 10
  RFX = ( VO - D1 ) / D1
  APHF(1) = XF1(1) + 0.5 * XF1(2) + 0.5 * XF1(3)
  APHF(2) = XF2(1) + 0.5 * XF2(2) + 0.5 * XF2(3)
  APHF(3) = XF3(1) + 0.5 * XF3(2) + 0.5 * XF3(3)
  APDF(1) = 0.5 * XF1(2) + XF1(4) + 0.5 * XF1(5)
  APDF(2) = 0.5 * XF2(2) + XF2(4) + 0.5 * XF2(5)
  APDF(3) = 0.5 * XF3(2) + XF3(4) + 0.5 * XF3(5)
  APTF(1) = 0.5 * XF1(3) + 0.5 * XF1(5) + XF1(6)
  APTF(2) = 0.5 * XF2(3) + 0.5 * XF2(5) + XF2(6)
  APTF(3) = 0.5 * XF3(3) + 0.5 * XF3(5) + XF3(6)
  HF = ( F1*APHF(1)+F2*APHF(2)+F3*APHF(3) ) / (F1+F2+F3) *1.0D02
  DF = ( F1*APDF(1)+F2*APDF(2)+F3*APDF(3) ) / (F1+F2+F3) *1.0D02
  TF = ( F1*APTF(1)+F2*APTF(2)+F3*APTF(3) ) / (F1+F2+F3) *1.0D02
  CALL MCDIST
  IF ( NR .GT. 0 ) GO TO 510
  IF ( ITR .LT. NTRL ) GO TO 550
510 CONTINUE
C ****      ****      ****      ****      ****      ****      ****      **
C **
C **      PRINT SUMMARY OF CALCULATIONS      **
C **
C ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
PRINT 3400
PRINT 3500, PT(NPR), ITR
PRINT 3600, NP, RFX
PRINT 3650, NS, NF1, NF2, NF3
PRINT 3675, F1, F2, F3, D1, D2, W
PRINT 3700
IF ( F1 .NE. 0.0 ) PRINT 4600, ( XF1(I), I = 1, NC ), HF,DF,TF
IF ( F2 .NE. 0.0 ) PRINT 4600, ( XF2(I), I = 1, NC ), HF,DF,TF
IF ( F3 .NE. 0.0 ) PRINT 4600, ( XF3(I), I = 1, NC ), HF,DF,TF
PRINT 1500
PRINT 4500, ( T(J), J = 1, NP )
PRINT 2700
PRINT 4500, ( PHITP(J), J = 1, NP )
PRINT 3800
PRINT 3900, NFO, ( Y(NFO,I), I = 1, NC ), APHY, APDY, APTY
IF ( NP .GT. 30 ) GO TO 525
DO 520 J = 1, NP
520 PRINT 3900, J, ( XC(J,I), I = 1, NC ), APH(J), APD(J), APT(J)
GO TO 550
525 CONTINUE
DO 530 J = 1, 15
530 PRINT 3900, J, ( XC(J,I), I = 1, NC ), APH(J), APD(J), APT(J)
PRINT 3850
DO 535 J = L9, NP
535 PRINT 3900, J, ( XC(J,I), I = 1, NC ), APH(J), APD(J), APT(J)
550 CCNTINUE
IF ( ITR .LT. NTRL ) GO TO 80
GC IC 70
900 STOP
C ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** 
C **
C **      FORMAT STATEMENTS      **
C **
C ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** 
1000 FORMAT ( 11i6 )
1020 FCRMAT ( '0', ' INPUT COEFFICIENTS TO CALCULATE ENTHALPIES, HL' )

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1025 FORMAT ( '0', ' INPUT COEFFICIENTS TO CALCULATE ENTHALPIES, HV' )
1100 FORMAT ( 9A8 )
1200 FCRMAT ( '0', ' FEED COMPOSITION' )
1300 FORMAT ( '0', ' POLYNOMIAL FITTING COEFFS. FOR EQLBM. CONSTANTS AT
1 PT=', 4P1D10.0, ' TORR' )
1400 FORMAT ( '1', ' CHECK OF INITIAL DISTRIBUTION COEFFICIENTS' )
1500 FORMAT ( '0', ' EQUILIBRIUM STAGE TEMPERATURES, DEG.K..(FROM L TO
1R IN ASCENDING ORDER OF PLATE NUMBER ) ' )
1600 FORMAT ( '0', ' DISTRIBUTION COEFFICIENTS' )
1650 FORMAT ( ( 4D18.6/1D18.6 ) )
1675 FORMAT ( 1P1D15.6, 1P6D15.6 )
2000 FCRMAT ( 6D12.6 )
2025 FORMAT ( '0', T35, ' TEMPERATURE/VAPOR PRESSURE DATA' )
2050 FORMAT ( 6D12.6 )
2700 FORMAT ( '0', ' SUMMATION OF LIQUID MOLE FRACTIONS.....(FROM L TO
1R IN ASCENDING ORDER OF PLATE NUMBER ) ' )
3400 FORMAT ( '1', ' CRYOGENIC DISTILLATION OF HYDROGEN ISOTOPES FOR ANL
1/TEPR, .. B.MISRA... ..NOVEMBER, 1975 ' )
3500 FORMAT ( '0', ' ISOTOPIC SEPARATION AT PT=', 1P1D12.3, ' TORR, APT
1ER NUMBER OF ITERATIONS=', 1I3 )
3600 FORMAT ( ' NUMBER OF THEORETICAL STAGES=', 1I3, ' REFLUX RATIO
1L/D1=', 1P1D12.3 )
3650 FORMAT ( ' SIDE STREAM LOCATION=', 1I3, ' 1ST FEED PLATE LOCATIO
1N=', 1I3, ' 2ND FP LOCATION=', 1I3, ' 3RD FP LOCATION=', 1I3 )
3675 FCRMAT ( ' FEED RATES:', 1P3D10.2, ' PRODUCTS:', 1P2D11.2, ' BO
1TTOMS:', 1P1D11.2 )
3700 FORMAT ( '0', ' FEED COMP.N-H2', T24, 'HD', T40, 'HT', T53, 'N-D2', T68, 'D
1T', T83, 'N-T2', T95, 'APH', T107, 'APD', T119, 'APT' )
3800 FORMAT ( '0', ' PLATE NO.', T15, 'N-H2', T29, 'HD', T44, 'HT', T59, 'N-D2',
1T75, 'DT', T89, 'N-T2', T102, 'APH', T114, 'APD', T126, 'APT' )
3850 FCRMAT ( '
1 *****
1 *****
3900 FORMAT ( 1I6, 1P6D15.6 , 1P3D12.3 )
4100 FCRMAT ( 1P5D15.6 )
4500 FORMAT ( 1P6D15.6 )
4600 FCRMAT ( 1P6D15.6, 1P3D12.3 )
END
C SUBROUTINE POLYFT DETERMINES EQUILIBRIUM CONSTANTS BASED ON L.SQ
SUBROUTINE POLYFT
IMPLICIT REAL*8 (A-H,O-Z)
DIMENSION A1(20,6), B1(20,1), CX1(5,6), CX2(5,6), CX3(5,6),
1CX4(5,6), CX5(5,6), DC(20,6), PT(5), RV1(5), VT(20), VP(20,6),
2W1(5), XK(20,6), X1(5,1)
COMMON/MISRA4/CX1, CX2, CX3, CX4, CX5, PT, VT, VP, NM1, M1, N1,
1NF1, IP, NC1, NR1
THRESH = 1.0D-10
DC 100 L = 1, NR1
DO 100 K = 1, NC1
DO 20 I = 1, NP1
DO 20 J = 1, IP
XK(I,J) = VP(I,K) / PT(L)
B1(I,J) = XK(I,J)
20 CCNTINUE
DO 30 I = 1, NP1
DC 30 J = 1, IP
DC(I,K) = XK(I,J)
30 CCNTINUE
DO 40 I = 1, M1
DO 40 J = 1, N1
XJ = J
A1(I,J) = VT(I) ** ( XJ - 1.0D00 )
40 CCNTINUE

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CALL MINFIT(NM1, M1, N1, A1, W1, IP, B1, IERR, RV1)
DC 50 J = 1, IP
DC 50 I = 1, N1
X1(I,J) = 0.0D00
50 CONTINUE
DC 70 K1 = 1, N1
IF ( W1(K1) .LT. THRESH ) GO TO 70
DC 60 I = 1, N1
DC 60 J = 1, IP
60 X1(I,J) = X1(I,J) + A1(I,K1) * B1(K1,J) / W1(K1)
70 CONTINUE
CX1(L,K) = X1(1,1)
CX2(L,K) = X1(2,1)
CX3(L,K) = X1(3,1)
CX4(L,K) = X1(4,1)
CX5(L,K) = X1(5,1)
100 CONTINUE
RETURN
END
C SUBROUTINE FOR SIMULATION OF MULTICOMPONENT DISTILLATION
SUBROUTINE MCDIST
IMPLICIT REAL*8 (A-H,O-Z)
DIMENSION A(50,50), B(50,6), APH(50), APD(50), APT(50), DPHTP(50),
1T(50), V(50), X(50,6), XF1(6), XF2(6), XF3(6), Y(50,6), XC(50,6),
2PHITP(50), TP(50), XK(50,6), C1(6), C2(6), C3(6), C4(6), C5(6)
COMMON/MISRA2/NP, M, INPUT, NF1, NF2, NF3, NS, NC, NTRL, NR,
1IFRNT, ITR, T, XC, Y, D1, D2, XF1, XF2, XF3, F1, F2, F3, V, W,
2QC, QW
COMMON/MISRA3/APH, APL, APT, APHY, APDY, APTY, C1, C2, C3, C4, C5,
1TB, TD, PHITP, VO
COMMON/MISRA6/L0, L1, L2, L3, L4, L5, L6, L7, L8
EQUIVALENCE ( B(1,1), X(1,1) )
COMMON /F402/PIVOT(100),INDEX(100)
ITR = 0
NFO = 1
L0 = NS - 1
L1 = NS + 1
L2 = NF1 - 1
L3 = NF1 + 1
L4 = NF2 - 1
L5 = NF2 + 1
L6 = NF3 - 1
L7 = NF3 + 1
L8 = NP - 1
IF ( IPRNT .GT. 0 ) GO TO 50
DC 20 J = 1, NP
XJ = J
XNJ = NP
DT = ( TB - TD ) / XNJ
20 T ( J ) = TD + DT * XJ
DO 30 J = 1, NP
30 V(J) = VO
DO 40 I = 1, NC
DO 40 J = 1, M
XK(J,I) = C1(I) + C2(I) * T(J) + C3(I) * T(J) ** (2.0D00) +
1C4(I) * T(J) ** (3.0D00) + C5(I) * T(J) ** (4.0D00 )
40 CONTINUE
50 CONTINUE
DC 60 L = 1, NC
B(NF1,L) = - F1 * XF1(L)
B(NF2,L) = - F2 * XF2(L)
B(NF3,L) = - F3 * XF3(L)

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60 CONTINUE
70 CCNTINUE
   ITR = ITR + 1
   DO 400 I = 1, NC
   DO 90 J = 1, NP
   XK(J,I) = C1(I) + C2(I) * T(J) + C3(I) * T(J) ** (2.0D00) +
1C4(I) * T(J) ** (3.0D00) + C5(I) * T(J) ** (4.0D00 )
90 CCNTINUE
   DO 110 J = 1, NP
   DC 110 K = 1, NP
110 A(J,K) = 0.0
   DC 120 K = 1, M
   DO 120 J = 1, NP
120 B(J,K) = 0.0
   DO 140 J = 1, NF0
   K = J
   A(J,K) = - ( V(J+1) + ( XK(J,I) - 1.0D00 ) * D1 )
   A(J,K+1) = V(J+1) * XK(J+1,I)
140 CCNTINUE
   DO 150 J = 2, L0
   K = J
   A(J,K) = - ( V(J) * XK(J,I) + V(J+1) - D1 )
   A(J,K-1) = V(J) - D1
   A(J,K+1) = V(J+1) * XK(J+1,I)
150 CONTINUE
   DC 156 J = NS, NS
   K = J
   A(J,K) = - ( V(J) * XK(J,I) + V(J+1) - D1 - D2 )
   A(J,K-1) = V(J) - D1
   A(J,K+1) = V(J+1) * XK(J+1,I)
156 CCNTINUE
   DO 160 J = L1, L2
   K = J
   A(J,K) = - ( V(J+1) - D1 - D2 + V(J) * XK(J,I) )
   A(J,K-1) = V(J) - D1 - D2
   A(J,K+1) = V(J+1) * XK(J+1,I)
160 CCNTINUE
   DO 170 J = NF1, NF1
   K = J
   A(J,K) = - ( V(J+1) - D1 - D2 + F1 + V(J) * XK(J,I) )
   A(J,K-1) = V(J) - D1 - D2
   A(J,K+1) = V(J+1) * XK(J+1,I)
170 CONTINUE
   DC 180 J = L3, L4
   K = J
   A(J,K) = - ( V(J+1) - D1 - D2 + F1 + V(J) * XK(J,I) )
   A(J,K-1) = V(J-1) - D1 - D2 + F1
   A(J,K+1) = V(J+1) * XK(J+1,I)
180 CONTINUE
   DC 190 J = NF2, NF2
   K = J
   A(J,K) = - ( V(J+1) - D1 - D2 + F1 + F2 + V(J) * XK(J,I) )
   A(J,K-1) = V(J) - D1 - D2 + F1
   A(J,K+1) = V(J+1) * XK(J+1,I)
190 CCNTINUE
   DO 200 J = L5, L6
   K = J
   A(J,K) = - ( V(J+1) - D1 - D2 + F1 + F2 + V(J) * XK(J,I) )
   A(J,K-1) = V(J) - D1 - D2 + F1 + F2
   A(J,K+1) = V(J+1) * XK(J+1,I)
200 CCNTINUE
   DC 210 J = NF3, NF3

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      K = J
      A(J,K) = - ( V(J) * XK(J,I) + V(J+1) + W )
      A(J,K-1) = V(J) - D1 - D2 + F1 + F2
      A(J,K+1) = V(J+1) * XK(J+1,I)
210  CONTINUE
      DC 220 J = L7, L8
      K = J
      A(J,K) = - ( V(J) * XK(J,I) + V(J+1) + W )
      A(J,K-1) = V(J) + W
      A(J,K+1) = V(J+1) * XK(J+1,I)
220  CONTINUE
      DC 230 J = NP, NP
      K = J
      A(J,K) = - ( W + V(J) * XK(J,I) )
      A(J,K-1) = W + V(J)
230  CCNTINUE
      DC 240 K = 1, M
      B(NF1,K) = - F1 * XF1(I)
      B(NF2,K) = - F2 * XF2(I)
      B(NF3,K) = - F3 * XF3(I)
240  CONTINUE
      CALL MATINV(A, NP, B, M, DETERM, 50)
      IFRNT = 1
      DC 300 J = 1, NP
      DO 300 K = 1, M
300  XC(J,I) = X(J,K)
400  CONTINUE
      DO 420 J = 1, NP
420  TF(J) = T(J)
      DO 500 J = 1, NP
      SUM = 0.0
      SUMX = 0.0
      SUMXC = 0.0
      DO 430 I = 1, NC
      IF ( XC(J,I) .GT. 0.0D00 ) GO TO 430
      XC(J,I) = 1.0D-10
      IX = 1
430  SUMXC = SUMXC + XC(J,I)
      DO 440 I = 1, NC
440  XC(J,I) = XC(J,I) / SUMXC
      DO 460 I = 1, NC
      SUMX = SUMX + XK(J,I) * XC(J,I)
460  PHITP(J) = SUMX
      IF ( IX .GE. 1 ) GO TO 470
      IF ( DABS(PHITP(J) - 1.0D00) .LE. 1.0D-09 ) GO TO 490
470  CONTINUE
      DC 480 I = 1, NC
      SUM = SUM + XC(J,I) * ( C2(I) + 2.0 * C3(I) * TP(J) + 3.0 * C4(I) *
1TP(J) ** (2.0D00) + 4.0 * C5(I) * TP(J) ** (3.0D00) )
      DPHITP(J) = SUM
      T(J) = TP(J) + ( 1.0 - PHITP(J) ) / DPHITP(J)
C  TEMPERATURE LIMITS ARE SET AS A PRECAUTIONARY MEASURE
      IF ( T(J) .LT. 20.0D00 ) T(J) = 20.0D00
      IF ( T(J) .GT. 30.0D00 ) T(J) = 30.0D00
480  CONTINUE
      IX = 0
490  CCNTINUE
      APH(J) = ( XC(J,1) + XC(J,2) * 0.50 + XC(J,3) * 0.50 ) / PHITP(J) *
11.0D02
      APD(J) = ( XC(J,2) * 0.50 + XC(J,4) + XC(J,5) * 0.50 ) / PHITP(J) *
11.0D02
      APT(J) = ( XC(J,3) * 0.50 + XC(J,5) * 0.50 + XC(J,6) ) / PHITP(J) *

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11.0D02
500 CONTINUE
   DO 505 J = 1, NP
   DO 505 I = 1, NC
   Y(J,I) = XC(J,I) * XK(J,I)
505 CCNTINUE
   APHY = (Y(NF0,1) + 0.50D00 * Y(NF0,2) + 0.50D00 * Y(NF0,3)) * 100.0
   APDY = (0.50D00 * Y(NF0,2) + Y(NF0,4) + 0.50D00 * Y(NF0,5)) * 100.0
   APTY = (0.50D00 * Y(NF0,3) + 0.50D00 * Y(NF0,5) + Y(NF0,6)) * 100.0
   IF ( ITR .EQ. NTRL ) GO TO 600
   GO TO 70
600 RETURN
   END
```