REFERENCE

NBS
PUBLICATIONS

NBSIR 86-3054

THE THERMODYNAMIC PROPERTIES OF NITROGEN TETROXIDE

A11102 564660

NAT'L INST OF STANDARDS & TECH R.I.C.

A11102564660

McCarty, Robert D/The thermodynamic prop
QC100 .U56 NO.86-3054 1988 V19 C.1 NBS-P

Robert D. McCarty
Hans-Ulrich Steurer
C.M. Daily

National Bureau of Standards
U.S. Department of Commerce
Boulder, Colorado 80303

July 1986

QC
100
.U56
86-3054
1986

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

NBS
RESEARCH
INFORMATION
CENTER

NBSIR 86-3054

THE THERMODYNAMIC PROPERTIES OF NITROGEN TETROXIDE

Robert D. McCarty
Hans-Ulrich Steurer
C.M. Daily

Thermophysics Division
Center for Chemical Engineering
National Engineering Laboratory
National Bureau of Standards
Boulder, Colorado 80303

July 1986

Sponsored by
NASA
John F. Kennedy Space Center, Florida 32899
(Final Report on NASA Contract CC-26848B)

U.S. DEPARTMENT OF COMMERCE, Malcolm Baldrige, Secretary

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, Director

Contents

		Page
1.	Introduction	1
2.	Literature Search	1
3.	N_2O_4 Dissociation	1
4.	Vapor Pressure	2
5.	Saturation Densities	2
6.	Conversion of P-ρ-T Data	3
7.	Equation of State for the Pure Components	7
8.	Mathematical Model of the Equation of State	9
9.	Derived Thermodynamic Properties	11
10.	Discussion	11
11.	Conclusions	11
12.	Acknowledgments	11
13.	References	12
Appendix A		18
Appendix B		31
Appendix C		78

List of Tables

Table 1.	Coefficients for eq (3)	2
Table 2.	Coefficients for eq (6)	3
Table 3.	Coefficients for eq (41)	10
Table 4.	Critical Point Constraints	10
Table A1.	Comparison of Experimental and Calculated Densities Used in Fitting eq (41)	19
Table A2.	Comparison of Calculated Vapor Pressures and Input Data to eq (3)	28
Table A3.	Comparison of Input and Calculated Saturated Liquid and Vapor Densities From eq (6)	29
Table B1.	Isobaric Tables of N_2O_4 Properties Calculated With Equations From This Work (SI Units)	32
Table B2.	Isobaric Tables of N_2O_4 Properties Calculated With Equations From This Work (Engineering Units)	55
Table C1.	Computer Program Listings	79

List of Figures

Figure 1.	ρ-T Plot of Input Data	4

Nomenclature

α	extent of reaction, eq (1)
β	extent of reaction, eq (2)
δ	binary interaction coefficient
f	fugacity
ρ	density
γ	nonlinear coefficient in eq (41)
A	arbitrary component, also B, C and D
a	amount of arbitrary component, also b, c and d
P	pressure
p	partial pressure
R	gas constant 0.00831434 $MPa \cdot dm^3 \cdot mol^{-1} \cdot K^{-1}$
T	temperature
Z	volume compressibility factor
x	mole fraction
χ	reduced variables

Superscript

o	ideal gas at 0.101325 MPa (1 atm)

Subscripts

σ	saturation
3	triple point
c	critical point
L	liquid
R	ideal gas
v	vapor
x	mixture
i,j	component

The Thermodynamic Properties of Nitrogen Tetroxide

Robert D. McCarty, Hans-Ulrich Steurer and C. M. Daily

Thermophysics Division
Center for Chemical Engineering
National Bureau of Standards
Boulder, Colorado 80303

A mathematical model of the equation of state of nitrogen tetroxide is presented. Isobaric tables of P-ρ-T and composition for temperatures from the triple point (261.95 K) to 600 K with pressures to 40 MPa are also given. The mathematical model of the equation of state is a 32 term modified Benedict-Webb-Rubin equation. A method of calculating chemical equilibrium for the system is also presented.

Key words: chemical equilibrium; composition; density; equation of state; nitrogen tetroxide; pressure; temperature.

1. Introduction

The thermodynamic properties of nitrogen tetroxide, hereafter referred to as N_2O_4, are of interest in at least two major areas. The fluid is widely used as an oxidizer for small rockets and as an agent in heat transfer problems. A search of the world's literature revealed a substantial experimental data base but few correlations of those data, and the correlations that do exist either cover only portions of the P-ρ-T surface or involve ideal gas assumptions which, for a wide range of pressures and temperatures, result in substantial inaccuracies. The National Bureau of Standards, under contract with NASA Kennedy Space Center, undertook a study to produce a correlation of the thermodynamic properties of N_2O_4 based on the existing experimental data. The following is the final report on that study.

2. Literature Search

A computerized search of the world's literature produced 172 titles concerned with N_2O_4. On the basis of the titles alone, 98 of the 172 appeared to be of possible use in the study. Copies of 62 of the selected references were eventually obtained. Many of these articles are in Russian, in fact 75 of the original 98 selected are of Soviet origin, and copies of some of the articles were difficult or impossible to obtain. A second selection process based on the actual contents of the obtained articles reduced this number even further and references [1-85] include all of the final selection plus those articles which could not be obtained and therefore remain as a possible source of pertinent information. During the course of the second selection process and subsequent correlation, eleven additional articles pertinent to the study were found. The literature search as described above provided an adequate experimental data base for the correlation of N_2O_4 properties.

3. N_2O_4 Dissociation

The fluid commonly referred to as N_2O_4 is not pure N_2O_4, but is in reality a mixture of N_2O_4, NO_2, NO, and O_2. This condition is a result of the following reactions taking place:

$$N_2O_4 \rightleftharpoons 2NO_2 \tag{1}$$

$$2NO_2 \rightleftharpoons 2NO + O_2 \tag{2}$$

The extent of these reactions depends on both pressure and temperature and therefore the equilibrium concentration of the various components changes from state point to state point. The time it takes for equilibrium to occur when the state conditions are changed will not be

addressed here, and only equilibrium conditions will be considered. Since the concentration of the various components changes with pressure and temperature, a knowledge of the composition at a given state point is necessary to construct an equation of state. The necessity of composition information complicates any correlation attempt via a mathematical model of the equation of state, and this problem will be discussed in the following sections. P-ρ-T relations of the saturated liquid and vapor are also necessary for the construction of an equation of state. Thus pressure-temperature as well as density-temperature correlations for the saturated liquid and vapor were developed.

4. Vapor Pressure

The chemical reactions described in the previous section have no affect on the dependence of vapor pressure on temperature; therefore, methods previously used [86] on pure fluids were used to produce a mathematical model of N_2O_4 vapor pressure as a function of temperature. Analysis of the vapor pressure data found in the literature led to the selection of the data reported by Giauque and Kemp [87] and Schlinger and Sage [88] to fit the function

$$\ln P = N_1 + N_2\chi + N_3\chi^2 + N_4\chi^3 + N_5\chi^4 + N_6\chi\,(1 - \chi)^{1.5} \tag{3}$$

where

$$\chi = (1 - T_{tr}/T)/(1 - T_{tr}/T_c) \tag{4}$$

and

T_{tr} = 261.95 K (triple point temperature)
T_c = 431.372 K (critical point temperature)

The temperature is in kelvin and the vapor pressure is in megapascal. The coefficients to eq (3) are given in Table 1.

Table 1. Coefficients for eq (3)

$N_1 = -3.98267618$	$N_2 = 5.680987615$	$N_3 = 4.725629483 \times 10^{-1}$
$N_4 = 1.036003737 \times 10^{-1}$	$N_5 = 4.376388591 \times 10^{-2}$	$N_6 = 3.674221706 \times 10^{-1}$

5. Saturation Densities

When formulating a mathematical model of the equation of state of a fluid which is to be a single function for both the liquid and vapor phases, the most difficult task is to get a good representation of the saturation boundary. Toward this end, the saturated liquid and vapor densities were correlated independently as a function of temperature; these functions, together with the vapor pressure equation described above, were used to define the saturation boundary to be used later as input data to the final fit of the global equation of state model. The data selected for the saturated density equations were those of Reamer and Sage [89] for the liquid phase and Mittasch et al. [90] for the vapor phase. The equation for both the liquid and the vapor is

$$\rho_\sigma = \rho_c + e^y\,(\rho_3 - \rho_c) \tag{5}$$

where

$$y = A_1 \ln \chi + \sum_{L=2}^{4} A_L \left(1 - \chi^{\frac{(L-5)}{3}}\right) + \sum_{L=5}^{9} A_L \left(1 - \chi^{\frac{(L-4)}{3}}\right) \qquad (6)$$

and

$$\chi = (T - T_c)/(T_{tr} - T_c)$$

Temperature is in kelvin, density is in kg/m^3, T_c and T_{tr} are defined above by the vapor pressure equation and the least squares coefficients are given in Table 2.

Table 2. Coefficients for eq (6)

Vapor Phase

A_1	$-2.2660241266 \times 10^1$	A_5	$-1.2654673246 \times 10^2$
A_2	$4.3895751856 \times 10^{-2}$	A_6	5.7529269561×10^1
A_3	-1.3003886603	A_7	$-1.3606674467 \times 10^1$
A_4	1.9421498376×10^1	$A_8 = A_9$	0.0

Liquid Phase

A_1	$-5.2151095219 \times 10^1$	A_6	2.1307429701×10^2
A_2	$8.3309705469 \times 10^{-2}$	A_7	$-9.6219871908 \times 10^1$
A_3	-2.5306505949	A_8	2.4246461727×10^1
A_4	3.9880390339×10^1	A_9	-2.4096196971
A_5	$-3.4384688608 \times 10^2$		

$\rho_c = 550.463\ kg/m^3$ $\qquad \rho_{tr_v} = 0.772\ kg/m^3$ $\qquad \rho_{tr_\ell} = 1518.18\ kg/m^3$

The triple point densities in Table 2 were obtained by extrapolation of the experimental data and the critical point density is from [88]. Comparisons between calculated and experimental saturation properties are given in Tables A1 through A3.

6. Conversion of P-ρ-T data

Experimental single phase P-ρ-T data from four sources, [34,79,88,89], and the P-ρ-T values for the saturation boundary calculated from eqs (3) and (5) were used to define the equation of state for N_2O_4. A fifth source of P-ρ-T data, [83], was determined to be inconsistent with the other four sources and was not used in the final least squares fit of the mathematical model. Figure 1 is a plot of all P-ρ-T data used in the final least squares fit. All of the densities in the P-ρ-T data mentioned were originally reported by the authors in mass density units (e.g., g/cm^3). Because of the chemical reaction indicated by eqs (1) and (2), use of the P-ρ-T data as input to the least squares estimation of the adjustable parameters of an equation of state which reduces to the ideal gas in the limit of zero density, requires the choice between one of two possible alternatives. The units of density

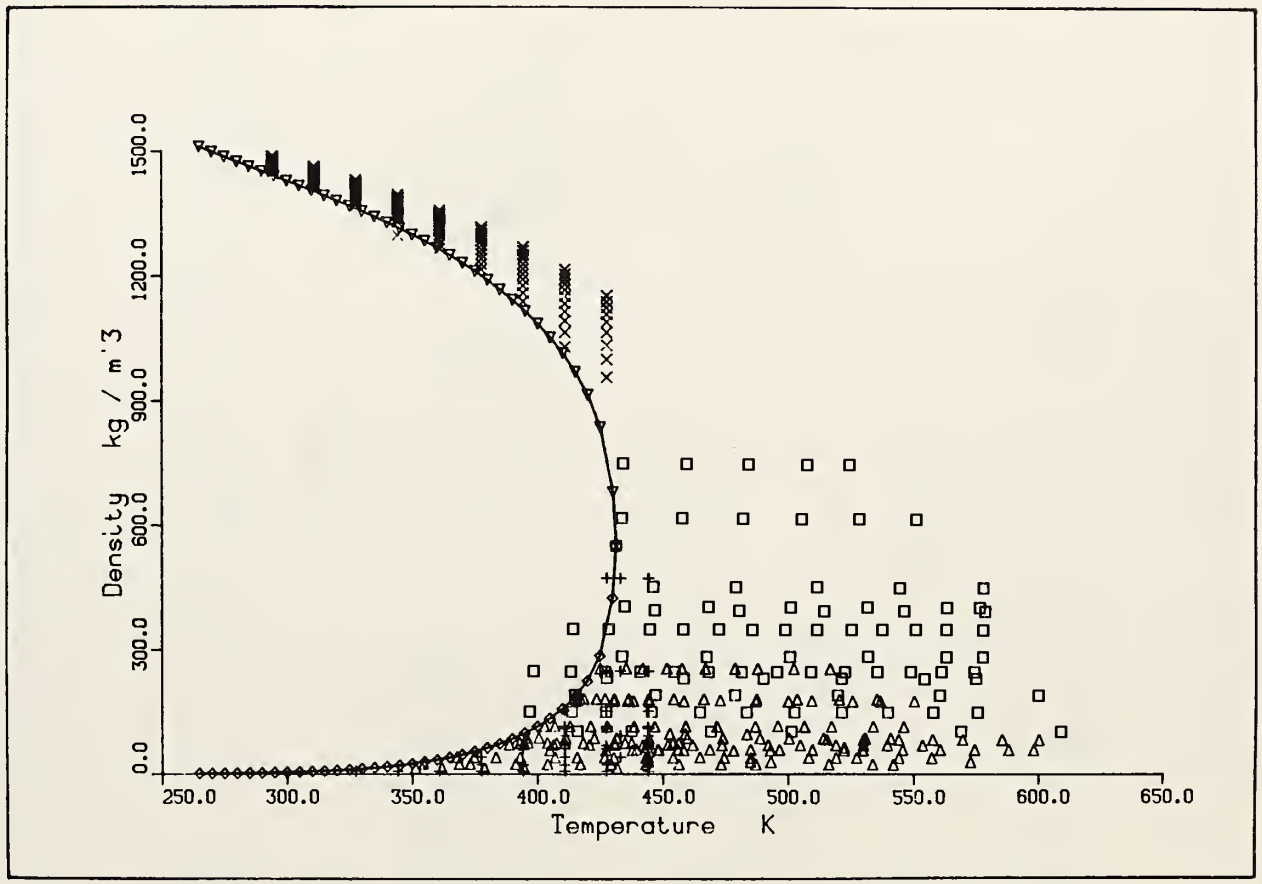

Figure 1. P-T Plot of Input Data, x from [90], □ from [80], + from [89], Δ from [35], ▽ from eq (5), ◇ from eq (5).

may be left in absolute units, in which case the value of the gas constant, R, is a function of the molecular mass, or the units of density may be changed to molar units (e.g., mol/L). Both of the options require a knowledge of the molecular mass, which in turn is a function of the changing composition. Very little information about the composition of the system at moderate and high densities was found in the search of the world's literature. The composition of the system may be calculated via thermodynamics if the equation of state for each of the pure components is known. In this particular case the equations of state for pure N_2O_4 and pure NO_2 are not available since neither fluid exists in a pure state over the global P-T range. Because of this, ideal gas assumptions are usually made which allow the composition calculation to be performed. This procedure works reasonably well at low and even moderate densities but is grossly in error in the liquid region. For a reaction of the type

$$aA + bB = cC + dD \tag{7}$$

the ΔG_R^o, which is the ideal gas Gibbs free energy of reaction at 0.101325 MPa 1 atm) and the temperature of the system, may be calculated by

$$\Delta G_R^o = cG_C^o + dG_D^o - aG_A^o - bG_B^o \tag{8}$$

where the G_C^o etc., are the ideal gas Gibbs free energies for the pure components at the same state conditions. In this case, the ideal gas Gibbs free energies are available in the literature; see, for example, [87,91,92]. Defining the extent of the reactions indicated by eqs (1) and (2) as α and β, respectively, and starting with one mole of N_2O_4, the molar amounts of the components are given by

$$n_{N_2O_4} = 1 - \alpha \ , \tag{9}$$

$$n_{NO_2} = 2\alpha - 2\alpha\beta \ , \tag{10}$$

$$n_{NO} = 2\alpha\beta \ , \tag{11}$$

and

$$n_{O_2} = \alpha\beta \ . \tag{12}$$

The equilibrium constant is

$$K = e^{-\frac{\Delta G_R^o}{RT}} \tag{13}$$

For the type of reaction described by eq (8), the equilibrium constant may also be written as

$$K = \frac{f_C^c \, f_D^d}{f_A^a \, f_B^b} \tag{14}$$

where the K is the same as in eq (13) and the f is the fugacity of the ith pure component. The relation between fugacity and partial pressure is given by

$$f = \gamma p \tag{15}$$

where γ is the fugacity coefficient. Assuming γ to be nearly 1 (ideal gas) then an approximation for K is given by

$$K = \frac{p_C^c \, p_D^d}{p_A^a \, p_B^b} \quad . \tag{16}$$

The partial pressure, by definition, is p = x P, which may be expressed as

$$p_{N_2O_4} = P(1 - \alpha)/(1 + \alpha + \alpha\beta) \quad , \tag{17}$$

$$p_{NO_2} = P(2\alpha - 2\alpha\beta)/(1 + \alpha + \alpha\beta) \quad , \tag{18}$$

$$p_{NO} = P(2\alpha\beta)/(1 + \alpha + \alpha\beta) \quad , \tag{19}$$

$$p_{O_2} = P(\alpha\beta)/(1 + \alpha + \alpha\beta) \tag{20}$$

where P is the total pressure of the system. The equilibrium constants for the two reactions are then

$$K_{eq\ (1)} = \frac{4\ \alpha^2(1 - \beta)^2 P}{(1 + \alpha + \alpha\beta)(1 - \alpha)} \tag{21}$$

and

$$K_{eq\ (2)} = \frac{\beta^{3/2}\ \alpha^{1/2}\ P^{1/2}}{(1 + \alpha + \alpha\beta)^{1/2}(1 - \beta)} \tag{22}$$

Now returning to eq (14) and removing the ideal gas assumption made by eq (16) and substituting p for f results in

$$K = \frac{p_C^c \, p_D^d \, \gamma_C^c \, \gamma_D^d}{p_A^a \, p_B^b \, \gamma_A^a \, \gamma_B^b} \tag{23}$$

Equating eq (23) to eq (13) and solving for the right side of eq (16) results in

$$\frac{p_C^c \, p_D^d}{p_A^a \, p_B^b} = e^{\frac{-\Delta G_R^o}{RT}} \frac{\gamma_A^a \, \gamma_B^b}{\gamma_C^c \, \gamma_D^d} \quad . \tag{24}$$

ΔG_R^o is available in the literature, and may be calculated provided equations of state for the pure components are available. Equilibrium constants calculated via eq (24) are

then equated to eqs (21) and (22) to solve for α and β, which in turn gives the average molecular mass of the system at a given P and T by

$$M = M_{N_2O_4}/(1 + \alpha + \alpha\beta) \quad . \tag{25}$$

7. Equation of State for the Pure Components

The procedure for determining the average molecular mass as outlined above requires the fugacity of the pure components of the mixture, and since neither N_2O_4 nor NO_2 exists as a pure fluid, a generalized equation of state proposed by Peng and Robinson [93] was used for N_2O_4 and NO_2. The Peng-Robinson equation of state is a two parameter equation of state of the form

$$P = \frac{RT}{v - b} - \frac{a(T)}{v(v + b) + b(v - b)} \tag{26}$$

which can be written as a cubic as

$$Z^3 = (1 - B)Z^2 + (A - 3B^2 - 2B)Z - (AB - B^2 - B^3) = 0 \tag{27}$$

where

$$A = \frac{a(T)P}{R^2\ T^2} \quad , \tag{28}$$

$$B = \frac{bP}{RT} \quad , \tag{29}$$

and

$$Z = \frac{P}{\rho RT} \quad . \tag{30}$$

At the critical point,

$$a(T) = 0.45724\ \frac{R^2\ T_c^2}{P_c} \quad , \tag{31}$$

$$b = 0.07780\ \frac{RT_c}{P_c} \quad , \tag{32}$$

and

$$Z_c = 0.307 \quad . \tag{33}$$

At temperatures other than the critical temperature,

$$a(T) = a(T_c)\ f(T_r, W) \tag{34}$$

where

$$f(T_r, W)^{1/2} = 1 + k(1 - T_r^{1/2}) \quad , \tag{35}$$

and

$$k = 0.37464 + 154226W - 0.26993W^2 \tag{36}$$

with $T_r = T/T_c$ and W is the acentric factor (i.e., $-\log_{10} \frac{P_{sat}}{P_c}\Big|_{T_r = 0.7}$). Given the critical pressure and temperature and the acentric factor, the fugacity coefficient of the ith component in a mixture can be calculated from

$$\ln f_i = b_i \left(\frac{Z_x - 1}{b_x}\right) - \ln (Z_x - b_x) - a_x \ln \left(\frac{Z_x + 2.414214\, b_x}{Z_x - 0.414214\, b_x}\right)\left(\frac{1}{2\sqrt{2}\, b_x}\right)\left(\frac{2 \sum_j x_j a_{ij}}{a_x} - \frac{b_i}{b_x}\right) \tag{37}$$

where

$$a_x = \sum \sum x_i x_j a_{ij} , \tag{38}$$

$$b_x = \sum x_i b_i , \tag{39}$$

and

$$a_{ij} = (1 - \delta_{ij}) a_i^{1/2} a_j^{1/2} . \tag{40}$$

The x_i is the mole fraction of component i and δ_{ij} is an empirical binary interaction parameter usually determined from experimental data. Since composition of the mixture is, in this case, the unknown, the solution becomes an iterative one. An initial value is assigned to the composition, usually obtained from the ideal gas solution; the extent of reaction is calculated which results in a new composition and the procedure is repeated until the composition stops changing. The critical pressure, the critical temperature and the acentric factor are all that is needed to carry out the composition calculation. These parameters were estimated by selecting 20 P-ρ-T data points for the liquid phase from [89], and 20 P-ρ-T data points for the vapor phase from [35,79,90]. The high density liquid data points were assigned a composition of pure N_2O_4, since Gray and Rathbone report only 0.12 percent disassociation of the liquid at the normal boiling point. The low density data points were assigned a composition of the equilibrium ideal gas. The acentric factor of N_2O_4 (0.0141345) was assigned to NO_2, ΔG_R^o was taken from the literature and the δ was set equal to zero. A nonlinear least squares minimization was then performed which minimized the sum of the squares of the deviations between the calculated and the assigned compositions of the 40 selected data points. The pseudo critical parameters of the hypothetical pure N_2O_4 and parameters of the hypothetical pure N_2O_4 and NO_2 were taken as the adjustable parameters. The least squares fit gave the following pseudo critical parameters:

N_2O_4:	T_c =	547.4567 K
	P_c =	22.0951 MPa
NO_2:	T_c =	239.3036 K
	P_c =	10.325 MPa

The critical parameters and acentric factors for the other components were taken to be:

NO:	T_c	=	180.15 K
	P_c	=	6.4848 MPa
	W	=	0.0312 acentric factor
O_2:	T_c	=	154.75 K
	P_c	=	5.0764 MPa
	W	=	0.0998 acentric factor.

All of the P-ρ-T data selected to define the equation of state were converted to molar densities via the method outlined above.

8. Mathematical Model of the Equation of State

A 32 term modified Benedict-Webb-Rubin equation of state was used to represent the equation of state of dissociated N_2O_4.

$$
\begin{aligned}
P = {} & \rho RT + \rho^2(N_1T + N_2T^{1/2} + N_3 + N_4/T + N_5/T^2) + \rho^3(N_6T + N_7 + N_8/T + N_9/T^2) \\
& + \rho^4(N_{10}T + N_{11} + N_{12}/T) + \rho^5(N_{13}) + \rho^6(N_{14}/T + N_{15}/T^2) \\
& + \rho^7(N_{16}/T) + \rho^8(N_{17}/T + N_{18}/T^2) + \rho^9(N_{19}/T^2) \\
& + e^{-\gamma\rho^2}[\rho^3(N_{20}/T^2 + N_{21}/T^3) + \rho^5(N_{22}/T^2 + N_{23}/T^4) \\
& + \rho^7(N_{24}/T^2 + N_{25}/T^3) + \rho^9(N_{26}/T^2 + N_{27}/T^4) \\
& + \rho^{11}(N_{28}/T^2 + N_{29}/T^3) + \rho^{13}(N_{30}/T^2 + N_{31}/T^3 + N_{32}/T^4)]
\end{aligned}
\tag{41}
$$

Taking $R = 0.00831434\ \mathrm{MPa \cdot dm^3 \cdot mol^{-1} \cdot K^{-1}}$ and $\gamma = -0.00698534$, a weighted least squares fit of 447 P-ρ-T data points was performed. The resulting coefficients to eq (41) are reported in Table 3. A comparison of the calculated and input densities and pressures is given in Appendix A in Table A1. Equation (41) was constrained to the critical point values given in Table 4.

Table 3. Coefficients for eq (41)

N(1)	=	$0.4597288295 \times 10^{1}$
N(2)	=	$-0.3108186437 \times 10^{3}$
N(3)	=	$0.6112269851 \times 10^{4}$
N(4)	=	$-0.8731107719 \times 10^{6}$
N(5)	=	$0.7131502732 \times 10^{8}$
N(6)	=	$-0.8503143208 \times 10^{-1}$
N(7)	=	$0.1445089748 \times 10^{3}$
N(8)	=	$-0.8889859726 \times 10^{5}$
N(9)	=	$-0.4972864114 \times 10^{10}$
N(10)	=	$0.2981177473 \times 10^{-2}$
N(11)	=	$-0.4158172241 \times 10^{1}$
N(12)	=	$0.2034429885 \times 10^{4}$
N(13)	=	$-0.4689856410 \times 10^{-1}$
N(14)	=	$0.1588311135 \times 10^{2}$
N(15)	=	$0.3679927661 \times 10^{5}$
N(16)	=	$-0.1540646223 \times 10^{1}$
N(17)	=	$0.4673519599 \times 10^{-1}$
N(18)	=	$0.7943347561 \times 10^{3}$
N(19)	=	$-0.2363315312 \times 10^{2}$
N(20)	=	$0.4996063056 \times 10^{10}$
N(21)	=	$-0.2341513119 \times 10^{10}$
N(22)	=	$0.3472302954 \times 10^{8}$
N(23)	=	$-0.1096418697 \times 10^{10}$
N(24)	=	$0.1138607202 \times 10^{6}$
N(25)	=	$-0.8323163631 \times 10^{5}$
N(26)	=	$0.2114987912 \times 10^{3}$
N(27)	=	$0.8381093548 \times 10^{5}$
N(28)	=	0.2821172947
N(29)	=	$-0.3595116964 \times 10^{1}$
N(30)	=	$0.1739254252 \times 10^{-3}$
N(31)	=	$0.1280112611 \times 10^{-1}$
N(32)	=	-0.8129759389

Table 4. Critical point constraints.

T_c	=	431.372 K
P_c	=	10.1578 MPa
ρ_c	=	550.463 kg/m^3
$\partial P/\partial \rho$	=	0.0
$\partial^2 P/\partial \rho^2$	=	0.0

9. Derived Thermodynamic Properties

In theory, if a valid equation of state exists for a fluid and the necessary ideal gas specific heat capacities exist, the derived thermodynamic properties such as the real gas enthalpies, entropies, etc. may be calculated. In the case of a chemically reacting fluid, a knowledge of the effects of the chemical reaction on these properties is also necessary. In the case of reacting N_2O_4, with the addition of eq (41), all of the necessary pieces to the calculation are available. The thermodynamic equations for these calculations are well known and may be found in many text books as well as in the world's literature; see, for example, Stai et al. [94]. There are many papers in the literature which report experimental specific heat capacities, enthalpies, and the velocity of sound for N_2O_4; see, for example, [31,65,95]. Equation (41) was used to calculate specific heat capacities which were compared to the experimental values found in the literature. The agreement was not good. Differences on the average of 30 to 50 percent were encountered. On the basis of these comparisons, derived properties were omitted from the property tables in Appendix B.

10. Discussion

In the initial stages of this investigation, least squares fits of eq (41) using the P-ρ-T data from the literature without regard to composition were unsuccessful. Even though eq (41) has 32 adjustable parameters, and therefore a good deal of flexibility, the fits to the unconverted data were not satisfactory. The gas phase data, without the liquid phase data, could be fit very well and vice versa, but when both liquid and gas data were included in the fit, deviations in density of several percent were observed. After the experimental densities were converted to molar densities via the method outline earlier in this paper, the least squares fits to all of the data improved, and judging from the comparisons in Appendix A, densities calculated with eq (41) are probably accurate to within 0.5 percent except in the usual problem areas of the saturation boundary and the critical region. However, as mentioned in the previous section, eq (41) does not calculate derived thermodynamic properties which agree with measured data reported in the literature.

11. Conclusions

Since the equation of state for N_2O_4 presented here does not perform well for derived thermodynamic properties such as specific heat capacities, etc., the correlation of N_2O_4 properties is only partially complete. This undoubtedly could be corrected by improving the composition calculation. The composition calculation could be improved by including specific heat capacity data with the P-ρ-T data as input to the fitting procedure of the Peng-Robinson equation of state for the hypothetical pure N_2O_4 and NO_2 fluids. However, this is a new and untried technique, and although it worked for the P-ρ-T data, including specific heat capacity as input, places an added demand on a very simple equation of state, and a more complicated equation of state may be necessary.

12. Acknowledgments

The authors wish to acknowledge the financial support of the NASA-Kennedy Space Center as well as the technical and moral support of numerous colleagues.

13. References

[1] Amirkhanov, Kh. I.; Polikhronidi, N. G.; Alibekov, B. G.; Batyrova, R. G. Isochoric heat capacity of dinitrogen tetroxide and the effect of dissociation on the dependence of $C_V(T)$. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk (4): 113-118; 1981.

[2] Avlasenko, P. V.; Gladkii, N. F. Thermal conductivity of a nitrogen tetroxide-nitric oxide solution in the liquid phase. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk (1): 68-69; 1982.

[3] Avlasenko, P. V.; Bubnov, V. P.; Kotelevskii, Yu. G.; Struchkov, V. I. Approximation of data on the viscosity and thermal conductivity of nitrogen tetroxide in the liquid phase. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk (4): 60-62; 1979.

[4] Bakalin, Yu. I.; Verba, M. I.; Portnov, V. D. Thermal conductivity of gas mixtures, reacting at a finite rate. Inzh.-Fiz. Zh. 14(5): 925-926; 1968.

[5] Bandyopadhyay, P. K. Heat conductivity of the system nitrogen tetroxide $\rightleftharpoons$ 2 nitrogen dioxide with diluents. J. Phys. D. 6(10): 1283-1286; 1973.

[6] Belyaeva, O. V.; Nikolaev, V. A. Experimental study of sound velocity in the nitrogen tetroxide-nitric oxide gaseous medium. Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk (1): 65-67; 1982.

[7] Belyaeva, O. V.; Timofeev, B. D.; Shupaev, V. N. Experimental study of the viscosity of liquid nitrogen tetroxide. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk (4): 78-81; 1980.

[8] Belyaeva, O. V.; Nikolaev, V. A.; Timofeev, B. D. Experimental study of the speed of sound and calculation of thermophysical characteristics of gaseous dissociating nitrogen tetroxide. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk (1): 65-73; 1976.

[9] Belyaeva, O. V.; Timofeev, B. D.; Yagodnitsyn, V. S. Dynamic-viscosity coefficient of gaseous dissociating dinitrogen tetroxide. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk (2): 65-70; 1974.

[10] Belyaeva, O. V.; Timofeev, B. D.; Yagodnitsyn, V. S. Dynamic viscosity of gaseous dissociating nitrogen tetroxide near the saturation line. Dissotsiiruyushchie Gazy Teplonositeli Rab. Tela Energ. Ustanovok: 12-19; 1973.

[11] Belyaeva, O. V.; Maksimov, B. G.; Nesterenko, V. B.; Pisarchik, V. N.; Pisarchik, V. N.; Pranovich, L. A.; Timofeev, B. D. Experimental study of the viscosity of $N_2O_4 \rightleftharpoons 2NO_2 \rightleftharpoons 2NO+O_2$ system at 300-780 K and 1-50 atmosphere. Teplo Massoperenos. 7: 447-451; 1968.

[12] Belyaeva, O. V.; Nikolaev, V. A.; Timofeev, B. D. Experimental study of the velocity of sound in the liquid phase of a nitrogen tetroxide-nitric oxide solution. Inst. Yad. Energy., Minsk, USSR.

[13] Belyaeva, O. V.; Nikolaev, V. A.; Timofeev, B. D. Study of the velocity of sound and calculation of density in liquid nitrogen tetroxide. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk.

[14] Bilyk, A. A.; Gladkii, N. F.; Kotelevskii, Yu. G.; Timofeev, B. D. Thermal conductivity of liquid nitrogen tetroxide in the 270-400 K and 0.1-20 megapascals ranges. Teploenergetika. (6): 75-76; 1975.

[15] Bilyk, A. A.; Gladkii, N. F.; Kotelevskii, Yu. G.; Timofeev, B. D. Thermal conductivity coefficients of dinitrogen tetroxide in liquid and dense gaseous states at supercritical pressures. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (1): 102-108; 1973.

[16] Bilyk, A. A.; Kotelevskii, Yu. G.; Timofeev, B. D. Coefficient of thermal conductivity of dissociating nitrogen tetroxide at elevated parameters. Novikov, I., ed. Teplofiz. Svoistva Gazov., Mater., Vses. Teplofiz Konf. Svoistvam Veshchestv Vys. Temp, 4th; 1973. 12-16.

[17] Bilyk, A. A.; Kotelevskii, Yu. G.; Mishina, L. V.; Sviridova, V. D.; Timofeev, B. D. Thermal conductivity coefficient of dissociating nitrogen tetroxide in a wide range of pressures and temperatures. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (4): 114-123; 1971.

[18] Bilyk, A. A.; Dresvyannikov, F. N.; Kotelevskii, Yu. G.; Mishina, L. V.; Nesterenko, V. B.; Timofeev, B. D. Thermal conductivity of $N_2O_4 \rightleftharpoons 2NO_2 \rightleftharpoons O_2$ system at 300-780 K and 1-50 atmosphere. Teplo Massoperenos. 7: 457-463; 1968.

[19] Blend, Harvey. Equilibriums in nitrogen dioxide. J. Chem. Phys. 53(12): 4497-4499; 1970.

[20] Bodman, S. W.; Brian, P. L. T.; Chang, T. C. Thermal conductivity of a nonequilibrium chemically reacting gas. A.I.Ch.E. J. 17(6): 1304-1310; 1971.

[21] Bubnov, V. P.; Gusarov, V. N.; Kuleshov, G. G.; Nesterenko, V. B.; Timofeev, B. D. Investigation of the P-V-T properties of dissociating nitrogen tetroxide. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Tekh. Navuk. (3): 129-134; 1966.

[22] Chao, J.; Wilhoit, R. C.; Zwolinski, B. J. Gas phase chemical equilibrium in dinitrogen trioxide and dinitrogen tetroxide. Thermochim. Acta. 10(4): 359-371; 1974.

[23] Dashuk, A. N.; Greben'kov, A. Zh.; Verzhinskaya, A. B.; Raiko, A. A.; Il'yukhin, Yu. D. Isobaric heat capacity of dissociating nitrogen tetroxide. II. Experimental study in the gas phase in the pressure range of 0.9-5 MPa. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (3): 59-64; 1981.

[24] Dashuk, A. N.; Greben'kov, A. Zh.; Verzhinskaya, A. B.; Il'yukhin, Yu. D.; Gladkii, N. F.; Timofeev, B. D. Experimental study of isobaric heat capcity and thermal conductivity of nitrogen oxide (N_2O_4-NO) solutions in the liquid phase. Inzh.-Fiz. Zh. 38; 1980.

[25] Dastidar, T. K. Rai; Bhattacharyya, P. K.; Barua, Asok K. Heat conductivity of the slowly dissociating system $2NO_2 = 2NO + O_2$ from 200 to 400 degrees. Trans. Faraday Soc. 65(11): 2913-2917; 1969.

[26] Dorst, F. W. Equilibrium of nitrogen dioxide and nitrogen peroxide. Naturwiss. Unterr., Phys./Chem. 27(10): 314-315; 1979.

[27] Dresvyannikov, F. N. Thermal conductivity of the $N_2O_4 <-> 2NO_2 <-> 2NO+O_2$ system. Inzh.-Fiz. Zh. 14(6): 1086-1090; 1968.

[28] Dresvyannikov, F. N.; Mukhachev, G. A. Heat conductivity of nitrogen dioxide in regions of high dissociation. Diuretic Rev: 234-242; 1965.

[29] Ermolenko, V. L.; Levchuk, N. F.; Trubnikov, V. P.; Yasnikov, V. E. Liquid-vapor equilibrium in the dinitrogen tetroxide-nitrogen monoxide system. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (4): 64-66; 1981.

[30] Gruzdev, V. A.; Slabnyak, V. I. Study of the equilibrium speed of sound in dissociating nitrogen tetroxide vapors. Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk. (3): 140-143; 1975.

[31] Gruzdev, V. A.; Komarov, S. G. Experimental study of the sound velocity and dispersion in dissociating nitrogen oxide (N_2O_4) vapors. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (3): 68-72; 1979.

[32] Gruzdev, V. A.; Komarov, S. G.; Yarmizin, S. V. Sound velocity in nitrogen tetroxide vapors and kinetics of the $N_2O_4 \rightleftharpoons 2NO_2$ reaction, Teplofiz. Svoistva Veshchestv Mater. 1979. 5-41.

[33] Il'yukhin, Yu. D.; Dashuk, A. N.; Povedailo, G. P.; Verzhinskaya, A. B.; Greben'kov, A. Zh.; Raiko, A. A. Experimental study of isobaric specific heat of equilibrium dissociating nitrogen tetroxide near the saturation line and in the near-critical region. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (3): 104-109; 1976.

[34] Klepatskii, P. M.; Mal'ko, M. V.; Shkarupa, T. F. Phase equilibrium in a dinitrogen tetroxide-nitrogen monoxide solution. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (4): 105-110; 1982.

[35] Klepatskii, P. M.; Shankin, V. F. P-V-T relation of dissociating dinitrogen tetroxide at P = 5-190 bar and T = 340-580 K. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (1): 68-76; 1975.

[36] Komarov, S. G. Experimental study of the velocity and dispersion of ultrasound in nitrogen tetroxide. Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk. (1): 57-61; 1976.

[37] Kuleshov, G. G. Thermodynamic properties of dissociating nitrogen tetroxide. II. Surface of metastable states. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (1): 77-80; 1972.

[38] Kuleshov, G. G. Thermodynamic properties of dissociating nitrogen tetroxide. I. Vapor pressure curve. Vestsi Akad. Navuk BSSR, Ser. Fiz.-Tekh. Navuk. (3): 53-59; 1967.

[39] Maksimov, B. G.; Podkorvtova, L. I. Viscosity of the nitrogen oxide (N_2O_4)-nitrogen oxide (NO) system in a dense gaseous state. Dissotsiiruyushchie Gazy Teplonositeli Rab. Tela Energ. Ustanovok. (1): 85-90; 1976.

[40] Maksimov, B. G.; Moiseenko, V. V.; Sinkevich, E. A. Excess thermodynamic functions of dissociating nitrogen tetroxide on the saturation line. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (4): 113-118; 1973.

[41] Maksimov, B. G. Fugacity and activity of the components of the system $N_2O_4 \rightleftharpoons 2NO_2$ along the saturation line. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (3): 117-123; 1973.

[42] Maksimov, B. G. Equilibrium of the liquid-phase dissociation of nitrogen tetroxide. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (4): 119-124; 1973.

[43] Maksimov, B. G.; Kotelevskii, Yu. G.; Serebryanyi, G. Z. Transport properties of nitrogen oxide (N_2O_4). in Termodin. Perenosnye Svoistva Khim. Reagiruyushchikh Gazov. Sist., Vol. 2. A. K. Krasin, ed. Russia: Nauka i Tekhnika, Minsk. Beloruss. SSR; 1971. 115-133.

[44] Maksimov, B. G.; Mishina, L. V.; Serebryanyi, G. Z.; Dunets, V. M. Nitrogen tetroxide (N_2O_4) viscosity in a dense gaseous state. Dokl. Akad. Nauk BSSR. 13(8): 691-693; 1969.

[45] Navarro, L. J.; Larrain, J. L.; Bonilla, C. F. Thermal conductivity of liquids by the a.c.-heated hot wire method (Dowtherm A and E, Dow Corning 710, Isopar M, Liquid G and nitrogen oxide (N_2O_4)). C. F. Bonilla, ed. Proc. Symp. Thermophys. Prop., 5th; 1970. 28-35.

[46] Nesterenko, V. B.; Gvozdev. A. A.; Doroshkevich, V. N.; et al. Thermophysical properties of nitrogen tetroxide. Minsk, USSR: Nauka i Tekhnika; 1982. 197 p.

[47] Nesterenko, V. B.; Berzhinskaya, A. B.; Bazhin, M. A.; Bubnov, V. P. Thermophysical properties of dissociating nitrogen tetroxide. Novikov, I. I., ed. 1974; Russia; Teplofiz. Svoistva Gazov., Mater. Vses. Konf. Teplofiz. Svoistvam, 5th; 1976. 18-21.

[48] Nesterenko, V. B.; Sirota, A. M.; Il'yukhin, Yu. D. Thermodynamic properties of dissociating nitrogen tetroxide at equilibrium at 50-175 kg force/cm2 and 140-500 deg. Teploenergetika. (7): 85-89; 1973.

[49] Nesterenko, V. B.; Il'yukhin, Yu. D.; Verzhinskaya, A. B.; Dashuk, A. N.; Raiko, A. A.; Povedailo, G. P. Experimental study of the isobaric heat capacity of nitrogen tetroxide dissociating under equilibrium conditions at 50-150 kg/cm2 and 140-500 deg. Dissotsiiruyushchie Gazy Teplonositeli Rab. Tela Energ. Ustanovok: 20-32; 1973.

[50] Nesterenko, V. B.; Timofeev, B. D.; Il'yukhin, Yu. D. Specific heat of dissociating nitrogen tetroxide equilibrium. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Tekh. Navuk. (4): 123-125; 1966.

[51] Nesterenko, V. B.; Bazhin, M. A.; Bubnov, V. P. Calculation of thermodynamic properties of dissociating nitrogen tetroxide taking account of nonideality. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Tekh. Navuk. (3): 20-24; 1966.

[52] Nikolaev, V. A.; Timofeev, B. D. Experimental data on the speed of sound in gaseous dissociating nitrogen tetroxide. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (3): 78-80; 1974.

[53] Orudzhaliev, E. A. Equilibrium sound velocity in a dissociating gas. Inzh.-Fiz. Zh. 41(2): 282-288; 1981.

[54] Plekhotkin, V. F. Second virial coefficients of nitrogen oxides. Zh. Fiz. Khim. 44(8): 2043-2045; 1970.

[55] Saeki, S.; Matsumoto, M.; Tamura, T. Determination of the equilibrium constant of nitrogen dioxide and dinitrogen tetroxide by infrared absorption spectroscopy. Bunseki Kagaku. 15(12): 1332-1338; 1966.

[56] San'ko, Yu. P.; Shashkov, A. G. Determination of the specific heat of nitric acid and nitrogen tetroxide in the -196 to +20 deg. range. Conference Proceedings.

[57] San'ko, Yu. P.; Shashkov, A. G. Determination of the coefficients of thermal conductivity and diffusivity of nitric acid and nitrogen tetroxide in the -196 to +20 deg. range, in Teplo- Massoobmen Nizk. Temp., A. V. Lykov, ed. Minsk, Beloruss, Russia: Nauka i Tekhnika; 1970. 131-141.

[58] Sarumov, Yu. A.; Gorbunova, N. I.; Sheindlin, A. E. Enthalpy of dissociating nitrogen tetroxide in a wide range of parameters of states. Abas-Zade, A. K., ed. Teplofiz. Svoistva Zhidk., Mater. Vses. Teplofiz. Konf. Svoistvam Veshchestv Vys. Temp., 3rd; 1970. 161-163.

[59] Saxena, S. C.; Gupta, G. P. Thermal conductivity of nitrous oxide in the temperature range 50 deg. to 900 deg. C. Chem. Phys. Lett. 4(5): 291-294; 1969.

[60] Semenov, A. M. Equation of state of a mixture of nonideal chemically reacting gases. Teplofiz. Vys. Temp. 10(3): 515-527; 1972.

[61] Serdyuk, L. S.; Tabachnikov, A. G. Thermodynamic properties of nitrogen oxide at 200-2000 K and up to 1000 bars. Inzh.-Fiz. Zh. 13(1): 114-117; 1967.

[62] Seshadri, D. P.; Viswanath, D. S.; Kuloor, N. R. Transport properties of the nitrogen oxide (N_2O_4)-nitrogen dioxide-nitric oxide-oxygen system. Indian Chem. Eng. 13(3): 50-56; 1971.

[63] Seshadri, D. N.; Viswanath, D. S.; Kuloor, N. R. Benedict-Webb-Rubin equation of state constants for $N_2O_4 \rightleftharpoons 2NO_2$, NO, and O_2. J. Chem. Eng. 12(1): 70-71; 1967.

[64] Shaw, A. W.; Vosper, A. J.; Pritchard, M. Dinitrogen trioxide. XII. Liquid dinitrogen trioxide solvent system. J. Chem. Soc. (20): 2172-2176. 1974.

[65] Sheindlin, A. E.; Gorbunova, N. I.; Simonov, V. M. Experimental study of enthalpy and heat of vaporization of nitrogen tetroxide at pressures of up to 300 atmospheres and temperatures up to 780 K. Proc. Symp. Thermophys. Prop., 7th; 518-524; 1977.

[66] Sheindlin, A. E.; Gorbunova, N. I.; Simonov, V. M. Experimental data on the enthalpy of nitrogen tetroxide. Teplofiz. Vys. Temp. 12(3): 666-669; 1974.

[67] Sheindlin, A. E.; Gorbunova, N. I.; Sarumov, Yu. A. Enthalpy of nitrogen tetroxide in the near-critical range of parameters of state. Teplofiz. Vys. Temp. 11(6): 1192-1197; 1973.

[68] Sheindlin, A. E.; Gorbunova, N. I. Caloric properties of nitrogen tetroxide in a wide range of parameters of state. Teploenergetika. (8): 22-25; 1973.

[69] Sheindlin, A. E.; Gorbunova, N. I. Caloric properties of nitrogen tetroxide within a wide-range of parameters of state. Therm. Eng. 20(8): 31-35; 1973.

[70] Sheindlin, A. E.; Gorbunova, N. I.; Simonov, V. M. Enthalpy of dissociating nitrogen tetroxide at pressures up to 30 megapascals and temperatures up to 782 K. Teplofiz. Vys. Temp. 15(4): 767-771; 1977.

[71] Sheindlin, A. E.; Gorbunova, N. I.; Sarumov, Yu. A. Enthalpy of the chemical reacting system $N_2O_4 \rightleftharpoons 2NO_2 \rightleftharpoons 2NO + O_2$. Dokl. Akad. Nauk SSSR. 186(4): 817-819; 1969.

[72] Svehia, R. A.; Brokaw, R. S. Thermodynamic and transport properties for the $N_2O_4 \rightleftharpoons 2NO_2 \rightleftharpoons 2NO + O_2$ system. NASA Tech. Note NASA-TN-D-3327; 1966. 58 p.

[73] Tabachnikov, A. G.; Mezheritskii, S. M. Thermodynamic properties of reacting N_2O_4-NO_2-NO-O_2 system at temperatures up to 2000 K and pressure to 500 bar. Teplofiz. Svoistva Zhidk. Gazov Vys. Temp. Plazmy., Tr. Vses. Konf.; 1969. 188-194.

[74] Tabachnikov, A. G.; Mezheritskii, S. M. Calculation of the viscosity of a stoichiometric mixture of nitrogen tetroxide and its decomposition products. Teplo Massoperenos. 7: 188-197; 1968.

[75] Timofeev, B. D. Thermophysical properties of nitrogen tetroxide. Dissotsiiruyushchie Gazy Teplonositeli Rab. Tela Energ. Ustanovok: 3-11; 1973.

[76] Timofeev, B. D. The viscosity of nitrogen tetroxide under atmospheric pressure. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Tekh. Navuk. (4): 27-31; 1966.

[77] Timrot, D. L.; Serednitskaya, M. A.; Traktueva, S. Viscosity of dissociating dinitrogen tetroxide studied by an oscillating-disk method. Teplofiz. Vys. Temp. 7(5): 885-892; 1969.

[78] Tsymarnyi, V. A. Density of liquid dinitrogen tetroxide at 300-510 K and up to 600 bars. Zh. Fiz. Khim. 45(1): 178-179; 1971.

[79] Tsymarnyi, V. A. PVT relations of nitrogen tetroxide. Teplofiz. Vys. Temp. 5(3): 541-543; 1967.

[80] Underwood, D. N.; Webster, D. E. The effect of pressure on the dissociation of dinitrogen tetroxide. Sch. Sci. Rev. 60(211): 309-311; 1978.

[81] Udovenko, A. G.; Konvisar, V. I.; Shapka, A. V.; Vorob'eva, T. A. Dissociation of nitrogen tetroxide. Zh. Prikl. Khim. 49(9): 1945-1948; 1976.

[82] Verzhinskaya, A. B.; Greben'kov, A. Zh.; Dashuk, A. N.; Il'yukhin, Yu. D. Experimental study of the isobaric heat capacity of dissociating nitrogen peroxide-nitric oxide solutions in the gas phase. Vestsi Akad. Navuk BSSR. Ser. Fiz.-Energ. Navuk. (1): 69-73; 1982.

[83] Verzhinskaya, A. B.; Khasanshin, T. S. Experimental study of the p-v-T dependence of dissociating nitrogen tetroxide in a wide range of temperatures and pressures. Dissotsiiruyushchie Gazy Teplonositeli Rab. Tela Energ. Ustanovok: 195-202; 1970.

[84] Vityuk, L. S.; Golovskii, E. A.; Tabachnikov, A. G. Experimental study of thermodynamic properties of nitrogen tetroxide at 230-330 K. Deposited Document No. SPSTL 39 Khp-D80; 1980. 22 p.

[85] Vosper, A. J. Dinitrogen troxide. VIII. Vapor-liquid equilibriums in the system dinitrogen trioxide-dinitrogen tetroxide. J. Chem. Soc. A. (10): 1589-1592; 1971.

[86] McCarty, R. D. and Jacobsen, R. T. An equation of state for fluid ethylene. Nat. Bur. Stand. (U.S.) Tech. Note 1045; 1981 July.

[87] Giauque, W. F.; Kemp, J. D. The entropies of nitrogen tetroxide and nitrogen dioxide. J. Chem. Phys. 6: 40-52; 1938.

[88] Schlinger, W. G.; Sage, B. H. Volumetric behavior of nitrogen dioxide, Ind. Eng. Chem. 42: 2158-2163; 1950.

[89] Reamer, H. H.; Sage, B. H. Volumetric behavior of nitrogen dioxide in the liquid phase. Ind. Eng. Chem. 44: 185-187; 1952.

[90] Mittaseh, A.; Kuss, E.; Schlueter, H. Dichten und Donapfdruch von Wassigen Ammoniakloesungen. Z. Anorg. Allg. Chem. 159: 1-36; 1926.

[91] Aulkshuler, A. P. Thermodynamic functions for nitrogen dioxide and nitrous acid. J. Phys. Chem. 61; 1957.

[92] Hisatsune, I. C. Thermodynamic properties of some oxides of nitrogen. J. Phys. Chem. 65; 1961.

[93] Peng, Y. P.; Robinson, D. B. A two constant equation of state. Ind. Eng. Chem. Fundam. 15(1); 1976.

[94] Stai, D. F.; Bizjax, F.; Stephanov, S. E. Thermodynamic properties of nitrogen tetroxide. J. Spacecr. Rockets. 2(5); 1965 September.

[95] Nesterenko, V. B.; Sirota, A. M.; Il'yukhin, Y. D. An experimental investigation of the caloric properties of equilibrium dissociating nitrogen tetroxide at pressures of 50-175 kg/cm2 and temperatures of 140-500°C. Teploenergetika. 20(7): 85-89; 1973.

[96] Gray, P.; Rathbone, P. Dissociation of liquid dinitrogen tetroxide. J. Chem. Soc.: 3550-3557; 1958.

Appendix A.

Table A1. Comparison of experimental and calculated densities used in fitting Eq (41).

Pressure MPa	Density mol/L	Density kg/m^3	Temperature K	% difference in density	Ref
4.932	1.7492	104.3005	415.98	-0.26	80
5.930	1.8764	104.2004	437.56	-0.64	
7.271	2.0323	103.9999	469.14	-0.26	
8.426	2.1389	103.8008	501.27	-0.08	
10.394	2.2472	103.4993	568.95	-0.48	
11.463	2.2799	103.1997	608.91	0.42	
5.974	2.4275	151.2002	413.76	-0.75	
6.907	2.5339	151.0008	427.36	-0.59	
8.145	2.6767	150.9010	445.52	-0.17	
9.433	2.8144	150.7007	464.80	-0.12	
10.599	2.9308	150.6010	483.41	-0.06	
11.680	3.0266	150.3989	502.46	-0.03	
12.652	3.1024	150.2991	521.35	-0.04	
13.497	3.1571	150.1011	539.77	0.04	
14.296	3.1999	150.0007	557.90	0.04	
15.047	3.2310	149.8016	575.66	0.13	
9.653	3.3341	192.5010	447.02	-0.67	
12.436	3.6088	192.1978	478.75	-0.24	
15.568	3.8799	191.7015	519.75	-0.04	
18.191	4.0442	191.3007	560.56	-0.17	
20.448	4.1389	190.8993	600.10	0.74	
11.994	4.0555	232.7012	458.24	-0.17	
15.442	4.3712	232.3019	490.06	-0.01	
18.472	4.6245	231.8998	521.25	-0.00	
21.279	4.8133	231.4997	554.37	-0.07	
22.879	4.8948	231.1996	574.97	0.00	
10.375	4.1177	248.8002	440.99	-0.56	
12.031	4.2517	248.5996	454.50	-0.35	
13.688	4.3972	248.3979	468.20	-0.27	
15.257	4.5375	248.1975	481.41	-0.30	
16.846	4.6790	247.9996	495.37	-0.25	
18.327	4.8089	247.8995	509.22	-0.07	
19.690	4.9168	247.6987	522.56	-0.09	
20.945	5.0068	247.4971	535.47	-0.17	
22.177	5.0863	247.2990	548.81	-0.24	
23.265	5.1508	247.1973	561.20	-0.20	
24.396	5.2068	246.9995	574.31	-0.21	
9.926	4.5959	285.5995	433.76	0.12	
14.737	4.9318	284.9988	467.36	0.39	
19.358	5.3314	284.6027	500.61	0.01	
23.284	5.6379	284.0027	531.88	-0.23	
26.769	5.8601	283.4974	563.21	-0.28	
28.231	5.9384	283.2972	577.67	-0.04	
12.501	5.5725	351.2003	444.85	1.03	
14.942	5.6574	351.0033	458.09	-0.51	
17.573	5.8972	350.7039	472.42	-0.10	
20.005	6.1145	350.5030	485.59	-0.13	
22.371	6.3216	350.2025	498.76	-0.06	
24.587	6.5040	349.8988	511.37	-0.12	
26.899	6.6868	349.7003	525.10	-0.09	

Pressure MPa	Density mol/L	Density kg/m^3	Temperature K	% difference in density	Ref
28.917	6.8314	349.4034	537.52	-0.15	
30.952	6.9689	349.2030	550.68	-0.12	
32.770	7.0801	348.9021	563.08	-0.03	
34.909	7.1946	348.6989	577.77	-0.00	
20.536	6.6155	395.3988	480.26	-0.21	
27.724	7.2365	394.5976	514.22	-0.01	
34.040	7.6904	393.8984	546.26	-0.10	
39.771	8.0282	393.1977	578.56	0.11	
10.995	6.3484	405.4009	434.90	0.02	
25.317	7.1462	403.9989	500.90	0.39	
31.889	7.6423	403.1985	531.61	-0.06	
38.009	8.0382	402.3969	563.25	-0.04	
40.378	8.1711	402.1990	576.35	0.06	
22.030	7.2745	452.2004	479.09	-0.23	
30.366	8.0223	451.4031	511.44	0.34	
38.423	8.5958	450.4012	544.42	0.22	
45.922	9.0375	449.7027	577.87	0.14	
28.496	9.2143	616.6056	481.82	0.21	
38.152	9.9983	615.8064	505.31	0.42	
47.802	10.6285	614.9028	528.42	-0.03	
57.047	11.1697	614.1052	551.05	-0.45	
23.222	9.7317	748.3935	459.41	-0.42	
36.130	10.6546	747.2935	484.08	-0.34	
49.439	11.4677	746.1983	507.42	0.02	
59.358	12.0070	745.4066	524.25	0.33	
1.037	0.2941	14.2199	431.85	0.53	35
0.857	0.2675	14.2405	394.63	-0.39	
0.767	0.2507	14.2501	378.85	-0.78	
0.663	0.2302	14.2559	361.90	-0.15	
0.603	0.2174	14.2700	351.33	0.03	
2.354	0.5281	24.0183	541.98	0.26	
2.311	0.5265	24.0201	533.81	0.24	
2.219	0.5236	24.0501	516.23	0.37	
2.059	0.5175	24.1099	487.10	0.69	
1.977	0.5127	24.1196	473.20	0.76	
1.869	0.5046	24.1301	456.43	0.78	
1.779	0.4956	24.1453	443.17	0.54	
1.672	0.4830	24.1651	429.32	0.35	
1.567	0.4685	24.1784	417.15	0.22	
1.446	0.4493	24.1960	404.05	0.02	
1.322	0.4273	24.2097	391.36	-0.23	
1.136	0.3920	24.2349	373.13	-0.06	
1.096	0.3833	24.2394	368.75	-0.37	
0.961	0.3566	24.2583	354.54	0.36	
3.124	0.6607	29.7810	572.84	-0.15	
2.582	0.6413	29.9089	493.12	0.43	
2.522	0.6380	29.9216	484.93	0.49	
2.171	0.6095	29.9871	444.24	0.93	
4.030	0.8792	40.0103	557.38	-0.35	
3.754	0.8697	40.0712	527.36	-0.13	

Pressure MPa	Density mol/L	Density kg/m^3	Temperature K	% difference Ref in density
3.665	0.8668	40.0902	519.10	0.31
3.570	0.8623	40.1204	508.21	0.19
3.336	0.8491	40.1700	485.16	0.38
3.219	0.8404	40.1898	474.44	0.41
3.106	0.8307	40.2100	464.69	0.36
2.980	0.8176	40.2301	454.18	0.09
2.828	0.8008	40.2495	443.20	0.13
2.643	0.7778	40.2796	430.45	0.07
2.588	0.7659	40.2903	426.83	-0.54
2.412	0.7433	40.3094	415.87	-0.17
2.267	0.7202	40.3309	407.07	-0.30
2.035	0.6839	40.3601	393.08	0.05
1.870	0.6513	40.3798	383.47	-0.18
1.728	0.6256	40.4011	374.79	0.13
1.617	0.6047	40.4106	367.89	0.45
2.890	0.8180	41.0734	444.24	0.30
5.326	1.2414	57.5244	530.05	0.19
5.232	1.2365	57.5507	522.27	-0.03
4.782	1.2111	57.6403	492.93	0.43
4.537	1.1918	57.6830	478.21	0.47
4.170	1.1560	57.7467	458.39	0.36
3.968	1.1326	57.7821	448.46	0.23
3.735	1.1037	57.8073	437.85	0.19
3.493	1.0706	57.8403	427.42	0.14
2.953	0.9879	57.9069	404.93	-0.07
6.456	1.3086	58.9412	598.09	-0.13
6.315	1.3041	58.9724	588.07	-0.36
6.121	1.2982	59.0178	574.49	-0.46
5.928	1.2920	59.0603	560.77	-0.48
5.713	1.2847	59.1091	545.68	-0.34
5.481	1.2757	59.1615	529.74	-0.11
5.180	1.2608	59.2231	509.60	0.15
4.967	1.2482	59.2663	496.54	0.39
4.778	1.2339	59.3010	485.03	0.34
4.476	1.2077	59.3548	468.74	0.47
4.226	1.1809	59.3932	456.06	0.27
4.056	1.1606	59.4184	447.94	0.09
3.867	1.1300	59.4461	439.52	-0.64
5.864	1.3912	64.9492	522.40	0.02
4.287	1.2512	65.2183	443.80	-0.12
6.889	1.5306	70.4030	553.71	-0.31
6.643	1.5210	70.4517	539.58	-0.18
6.472	1.5134	70.4812	530.04	-0.05
6.276	1.5037	70.5316	519.06	0.04
5.742	1.4696	70.6308	492.12	0.41
5.336	1.4342	70.7010	473.59	0.37
5.058	1.4053	70.7408	461.99	0.23
4.802	1.3765	70.7817	452.13	0.17
4.527	1.3430	70.8216	442.08	0.11
4.203	1.3004	70.8624	430.93	0.10

Pressure MPa	Density mol/L	Density kg/m^3	Temperature K	% difference Ref in density
3.901	1.2580	70.9027	420.81	0.11
3.465	1.1929	70.9518	406.45	0.27
3.112	1.1375	70.9910	394.70	0.59
2.939	1.1096	71.0131	388.77	0.78
5.179	1.4700	75.2229	456.36	0.05
5.114	1.4616	75.2327	453.97	-0.08
4.829	1.4272	75.2667	444.27	-0.15
4.814	1.4265	75.2736	443.98	0.02
4.628	1.4011	75.2966	437.58	-0.26
4.543	1.3906	75.3074	434.97	-0.18
4.406	1.3726	75.3244	430.68	-0.13
4.011	1.3161	75.3243	418.34	-0.20
3.785	1.2809	75.4038	410.92	-0.60
3.660	1.2657	75.4147	407.64	0.12
3.543	1.2480	75.4261	404.03	0.22
3.294	1.2099	75.4587	396.30	0.53
3.189	1.1937	75.4726	393.00	0.73
9.060	1.8429	83.3830	600.25	0.55
8.759	1.8333	83.4447	585.46	0.10
8.436	1.8227	83.5216	569.70	-0.09
8.183	1.8140	83.5776	557.71	-0.04
7.895	1.8025	83.6336	544.14	0.07
7.589	1.7884	83.6969	529.99	0.22
7.255	1.7703	83.7652	515.41	0.46
8.164	1.8648	86.7903	540.92	-0.68
7.931	1.8540	86.8432	530.82	-0.54
7.529	1.8314	86.9194	514.05	-0.34
7.182	1.8078	86.9881	500.38	-0.23
6.858	1.7829	87.0475	488.78	-0.05
6.425	1.7426	87.1086	473.96	-0.11
5.976	1.6950	87.1922	459.78	-0.28
5.443	1.6320	87.2517	444.40	-0.42
4.974	1.5721	87.3135	431.67	-0.45
4.637	1.5269	87.3513	422.80	-0.37
4.192	1.4650	87.3968	411.25	-0.05
3.791	1.4067	87.4501	400.63	0.25
3.609	1.3798	87.4810	395.74	0.54
7.393	1.9661	97.4475	483.62	0.01
6.504	1.8746	97.5687	458.91	-0.15
6.262	1.8491	97.6090	452.83	-0.02
10.785	2.4615	115.1821	546.18	-0.28
10.393	2.4415	115.2606	534.03	-0.17
9.823	2.4068	115.3532	517.31	0.01
9.431	2.3792	115.4317	506.46	0.11
9.027	2.3466	115.4875	495.81	0.13
8.667	2.3156	115.5538	486.95	0.20
8.011	2.2516	115.6605	471.59	0.10
7.438	2.1896	115.7133	459.16	-0.02
6.836	2.1206	115.7930	446.80	-0.09
6.419	2.0715	115.8345	438.62	-0.00

Pressure MPa	Density mol/L	Density kg/m^3	Temperature K	% difference in density	Ref
5.876	2.0026	115.9037	427.91	-0.12	
5.540	1.9590	115.9544	421.31	-0.18	
5.105	1.9038	115.9958	413.03	0.21	
4.792	1.8631	116.0226	406.97	0.56	
4.583	1.8359	116.0638	402.86	0.81	
16.264	3.7117	176.3061	550.36	-0.09	
15.495	3.6671	176.4306	536.78	-0.00	
14.839	3.6244	176.5522	525.73	0.10	
13.813	3.5479	176.7100	509.45	0.21	
13.188	3.4961	176.8008	500.09	0.23	
12.266	3.4149	176.9295	487.11	0.30	
11.209	3.3131	177.0531	472.92	0.19	
10.044	3.2001	177.1777	458.48	0.52	
8.926	3.0839	177.3027	444.69	0.44	
8.907	3.0815	177.3036	444.43	0.39	
8.406	3.0293	177.3670	438.35	0.39	
8.216	3.0103	177.3973	436.10	0.47	
7.765	2.9637	177.4289	430.70	0.57	
7.767	2.9630	177.4312	430.66	0.44	
6.543	2.8376	177.5882	415.88	0.57	
15.797	3.7583	181.3568	535.54	0.11	
14.860	3.6935	181.4875	520.47	0.19	
13.688	3.6060	181.6536	503.63	0.64	
12.555	3.5018	181.8159	487.46	0.32	
10.907	3.3449	182.1473	466.40	0.27	
9.903	3.2432	182.1497	454.39	0.32	
9.050	3.1564	182.2503	444.31	0.34	
8.383	3.0880	182.3155	436.50	0.34	
7.889	3.0380	182.3805	430.75	0.39	
7.579	3.0054	182.4135	427.05	0.22	
7.289	2.9754	182.4494	423.61	0.09	
6.749	2.9210	182.4810	417.29	0.01	
6.863	2.9323	182.4810	418.61	-0.01	
6.641	2.9109	182.5146	416.04	0.07	
6.533	2.9015	182.5154	414.86	0.36	
19.533	5.0008	255.1006	516.74	0.20	
17.931	4.8715	255.2963	502.26	0.36	
16.261	4.7273	255.4917	487.89	0.48	
8.426	4.0922	256.3457	425.09	-0.28	
0.247	0.0936	6.5170	327.59	0.08	89
0.290	0.1035	6.5119	344.26	-0.55	
0.338	0.1136	6.5071	360.93	-1.13	
0.383	0.1224	6.5015	377.59	-1.24	
1.103	0.3684	22.0514	377.59	-1.15	
1.802	0.6425	41.0304	377.59	-0.51	
0.423	0.1298	6.4964	394.26	-0.65	
1.256	0.3972	22.0334	394.26	-1.00	
2.783	0.9865	60.7455	394.26	0.25	
3.062	1.1112	69.3589	394.26	-0.00	
0.458	0.1344	6.4911	410.93	-0.53	

Pressure MPa	Density mol/L	Density kg/m^3	Temperature K	% difference in density	Ref
1.400	0.4185	22.0155	410.93	-1.28	
2.374	0.7406	40.9679	410.93	-0.90	
3.218	1.0549	60.6988	410.93	-0.24	
3.555	1.1878	69.3013	410.93	-0.38	
4.351	1.5422	92.6682	410.93	-0.17	
4.858	1.8021	110.1449	410.93	-0.20	
4.993	1.8793	115.3577	410.93	-0.13	
5.803	2.4344	153.1564	410.93	-0.36	
0.488	0.1372	6.4856	427.59	-0.66	
1.528	0.4406	21.9974	427.59	-0.03	
3.647	1.1176	60.6532	427.59	-0.39	
4.044	1.2595	69.2449	427.59	-0.33	
5.676	1.9126	110.0554	427.59	-0.34	
5.850	1.9898	115.2558	427.59	-0.43	
6.972	2.5668	153.0378	427.59	-0.48	
8.712	4.0147	249.9753	427.59	-1.04	
2.730	0.7938	40.9258	433.15	-0.42	
5.243	1.6652	92.5758	433.15	-0.20	
9.394	4.0640	249.9364	433.15	-0.19	
0.515	0.1390	6.4809	444.26	-0.72	
1.642	0.4539	21.9785	444.26	0.27	
2.891	0.8147	40.9052	444.26	-0.14	
4.065	1.1707	60.6070	444.26	-0.71	
5.676	1.7205	92.5185	444.26	-0.13	
6.480	2.0127	109.9643	444.26	-0.33	
6.698	2.0944	115.1670	444.26	-0.42	
8.147	2.6975	152.9054	444.26	-0.53	
10.767	4.1672	249.7839	444.26	0.14	
3.447	15.7199	1445.7004	294.26	-0.09	90
6.895	15.7909	1452.2666	294.26	0.06	
10.342	15.8480	1457.5532	294.26	0.12	
13.790	15.9054	1462.8667	294.26	0.18	
17.237	15.9342	1465.5504	294.26	0.07	
20.684	15.9778	1469.5853	294.26	0.05	
24.132	16.0364	1475.0039	294.26	0.11	
27.579	16.0654	1477.7111	294.26	-0.01	
31.026	16.1246	1483.1849	294.26	0.06	
34.474	16.1693	1487.3215	294.26	0.02	
3.447	15.3295	1408.8405	310.93	-0.04	
6.895	15.3825	1413.8048	310.93	-0.06	
10.342	15.4500	1420.0849	310.93	0.03	
13.790	15.5038	1425.1202	310.93	0.03	
17.237	15.5586	1430.2276	310.93	0.03	
20.684	15.5997	1434.0623	310.93	-0.04	
24.132	15.6551	1439.2200	310.93	-0.03	
27.579	15.7109	1444.4023	310.93	-0.01	
31.026	15.7672	1449.6334	310.93	0.02	
34.474	15.8096	1453.5751	310.93	-0.05	
37.921	15.8523	1457.5488	310.93	-0.11	
41.369	15.9098	1462.8769	310.93	-0.09	

Pressure MPa	Density mol/L	Density kg/m^3	Temperature K	% difference Ref in density
3.447	14.9043	1367.9333	327.59	-0.03
6.895	14.9660	1373.7974	327.59	-0.06
10.342	15.0286	1379.7048	327.59	-0.07
13.790	15.0791	1384.4903	327.59	-0.16
17.237	15.1561	1391.6983	327.59	-0.06
20.684	15.2208	1397.7672	327.59	-0.03
24.132	15.2862	1403.8918	327.59	0.01
27.579	15.3387	1408.8258	327.59	-0.04
31.026	15.4056	1415.0700	327.59	0.02
34.474	15.4454	1418.8270	327.59	-0.10
37.921	15.4993	1423.8725	327.59	-0.13
41.369	15.5675	1430.2229	327.59	-0.06
6.895	14.5036	1328.2225	344.26	-0.11
10.342	14.5969	1337.0923	344.26	-0.00
13.790	14.6674	1343.8334	344.26	-0.03
17.237	14.7511	1351.7628	344.26	0.04
20.684	14.8236	1358.6579	344.26	0.05
24.132	14.8969	1365.5998	344.26	0.08
27.579	14.9584	1371.4427	344.26	0.04
31.026	15.0205	1377.3355	344.26	0.01
34.474	15.0833	1383.2782	344.26	-0.01
37.921	15.1339	1388.0931	344.26	-0.10
41.369	15.2111	1395.3427	344.26	-0.01
3.447	13.8748	1264.5938	360.93	-0.31
6.895	13.9936	1276.1576	360.93	-0.18
10.342	14.1086	1287.2479	360.93	-0.04
13.790	14.2136	1297.3639	360.93	0.05
17.237	14.3043	1306.1286	360.93	0.07
20.684	14.3922	1314.6081	360.93	0.10
24.132	14.4743	1322.5221	360.93	0.10
27.579	14.5557	1330.3384	360.93	0.12
31.026	14.6233	1336.8810	360.93	0.06
34.474	14.6957	1343.8280	360.93	0.05
37.921	14.7628	1350.2820	360.93	0.01
41.369	14.8359	1357.2556	360.93	0.03
6.895	13.4192	1214.9109	377.59	-0.23
10.342	13.5529	1228.1338	377.59	-0.18
13.790	13.6816	1240.7762	377.59	-0.09
17.237	13.7939	1251.8336	377.59	-0.08
20.684	13.9026	1262.4956	377.59	-0.04
24.132	14.0181	1273.7237	377.59	0.08
27.579	14.1209	1283.7419	377.59	0.15
31.026	14.2061	1292.1166	377.59	0.11
34.474	14.2898	1300.3163	377.59	0.09
37.921	14.3818	1309.2368	377.59	0.15
41.369	14.4612	1316.9788	377.59	0.14
6.895	12.7367	1138.8123	394.26	-0.13
10.342	12.9364	1158.7416	394.26	-0.05
13.790	13.1152	1176.5286	394.26	0.06
17.237	13.2646	1191.5074	394.26	0.06

Pressure MPa	Density mol/L	Density kg/m^3	Temperature K	% difference in density	Ref
20.684	13.3874	1203.9526	394.26	-0.03	
24.132	13.5134	1216.5736	394.26	-0.03	
27.579	13.6368	1228.8736	394.26	0.02	
31.026	13.7526	1240.3976	394.26	0.07	
34.474	13.8508	1250.2603	394.26	0.02	
37.921	13.9506	1260.2081	394.26	0.03	
41.369	14.0424	1269.3840	394.26	0.01	
6.895	11.7673	1029.4641	410.93	0.63	
10.342	12.1203	1064.2805	410.93	0.33	
13.790	12.4019	1092.2906	410.93	0.28	
17.237	12.6195	1114.3208	410.93	0.17	
20.684	12.8043	1133.1692	410.93	0.07	
24.132	12.9772	1150.7432	410.93	0.07	
27.579	13.1306	1166.4093	410.93	0.06	
31.026	13.2622	1179.9864	410.93	-0.01	
34.474	13.3800	1192.2004	410.93	-0.11	
37.921	13.4949	1204.0352	410.93	-0.15	
41.369	13.6043	1215.2800	410.93	-0.18	
13.790	11.2150	956.6140	427.59	0.51	
17.237	11.6579	999.7740	427.59	-0.15	
20.684	11.9993	1033.7213	427.59	-0.25	
24.132	12.3039	1064.0702	427.59	-0.01	
27.579	12.5562	1089.5555	427.59	0.19	
31.026	12.7273	1107.7027	427.59	-0.00	
34.474	12.8715	1123.2308	427.59	-0.23	
37.921	13.0103	1138.0718	427.59	-0.35	
41.369	13.1475	1152.5676	427.59	-0.39	
0.022	0.0101	0.8495	265.00	-0.08	eq.(5)
0.029	0.0132	1.0958	270.00	-0.22	
0.039	0.0170	1.3976	275.00	-0.40	
0.050	0.0217	1.7669	280.00	-0.60	
0.065	0.0274	2.2149	285.00	-0.74	
0.083	0.0345	2.7549	290.00	-0.87	
0.105	0.0431	3.4027	295.00	-0.93	
0.132	0.0534	4.1749	300.00	-1.00	
0.164	0.0659	5.0914	305.00	-1.01	
0.204	0.0808	6.1762	310.00	-0.95	
0.251	0.0987	7.4530	315.00	-0.87	
0.308	0.1199	8.9531	320.00	-0.73	
0.375	0.1450	10.7065	325.00	-0.58	
0.455	0.1748	12.7529	330.00	-0.38	
0.549	0.2098	15.1372	335.00	-0.14	
0.659	0.2510	17.9056	340.00	0.11	
0.787	0.2993	21.1173	345.00	0.39	
0.937	0.3559	24.8359	350.00	0.67	
1.111	0.4221	29.1379	355.00	1.00	
1.313	0.4930	33.6706	360.00	0.03	
1.545	0.5800	39.2084	365.00	-0.01	
1.811	0.6820	45.6648	370.00	0.07	
2.117	0.8000	53.0624	375.00	0.03	

Pressure MPa	Density mol/L	Density kg/m^3	Temperature K	% difference in density	Ref
2.466	0.9380	61.6115	380.00	0.02	
2.864	1.0990	71.6048	385.00	-0.03	
3.317	1.2890	83.3510	390.00	-0.00	
3.831	1.5130	97.1724	395.00	-0.01	
4.412	1.7800	113.6226	400.00	-0.02	
5.069	2.1030	133.5436	405.00	0.01	
5.809	2.4990	158.0205	410.00	-0.04	
6.642	3.0020	189.2098	415.00	-0.10	
7.579	3.6700	231.0539	420.00	-0.17	
8.630	4.6300	291.7277	425.00	0.07	
0.022	16.4710	1510.7554	265.00	-0.19	eq.(5)
0.029	16.3142	1498.7276	270.00	-0.05	
0.039	16.1851	1486.8510	275.00	0.08	
0.050	16.0574	1475.0943	280.00	0.12	
0.065	15.9306	1463.4228	285.00	0.11	
0.083	15.8044	1451.7987	290.00	0.09	
0.105	15.6786	1440.1885	295.00	0.05	
0.132	15.5419	1428.5467	300.00	-0.06	
0.164	15.4167	1416.8356	305.00	-0.09	
0.204	15.2910	1405.0044	310.00	-0.10	
0.251	15.1647	1393.0074	315.00	-0.11	
0.308	15.0372	1380.7920	320.00	-0.10	
0.375	14.9082	1368.3013	325.00	-0.08	
0.455	14.7769	1355.4746	330.00	-0.05	
0.549	14.6429	1342.2425	335.00	-0.01	
0.659	14.5060	1328.5360	340.00	0.04	
0.787	14.3642	1314.2741	345.00	0.08	
0.937	14.2177	1299.3686	350.00	0.11	
1.111	14.0659	1283.7232	355.00	0.15	
1.313	13.9076	1267.2310	360.00	0.17	
1.545	13.7420	1249.7712	365.00	0.19	
1.811	13.5678	1231.2062	370.00	0.19	
2.117	13.3836	1211.3774	375.00	0.17	
2.466	13.1879	1190.1044	380.00	0.13	
2.864	12.9786	1167.1679	385.00	0.08	
3.317	12.7531	1142.2965	390.00	0.01	
3.831	12.5078	1115.1477	395.00	-0.08	
4.412	12.2379	1085.2535	400.00	-0.17	
5.069	11.9358	1051.9348	405.00	-0.26	
5.809	11.5888	1014.1022	410.00	-0.32	
6.642	11.1736	969.7638	415.00	-0.31	
7.579	10.6379	914.5725	420.00	-0.13	
8.630	9.8325	836.1833	425.00	0.31	
9.809	8.0985	680.1712	430.00	-0.39	

Table A2. Camparison of vapor pressures calculated from equation 3 and input data from references [87,88].

Temperature K	Experimental Pressure MPa	% Difference in Pressure
264.092	0.0210979	0.08
268.093	0.0264934	0.08
271.993	0.0328847	0.02
275.989	0.0407466	0.03
279.376	0.0486525	−0.00
284.267	0.0623738	−0.02
288.252	0.0759191	−0.04
292.187	0.0917335	−0.08
294.948	0.1044280	−0.08
310.928	0.2119430	−0.06
310.928	0.2114600	0.17
327.594	0.4137510	0.23
344.261	0.7680010	−0.10
344.261	0.7663460	0.11
344.261	0.7691730	−0.25
344.261	0.7671730	0.00
360.928	1.3538400	−0.03
377.594	2.2860800	0.27
377.594	2.2928300	−0.02
377.594	2.2958000	−0.14
394.261	3.7502300	0.01
410.928	5.9575700	−0.01
416.483	6.9119400	−0.05
422.039	7.9840600	0.11
422.039	7.9985400	−0.07

Table A3. Comparison of input and calculated saturated liquid and vapor densities from equation (6).

Liquid [89]

Temp K	Density kg/m^3	% difference in density
310.928	1400.2167	0.19
316.483	1386.8836	0.19
322.039	1372.6211	0.23
327.594	1358.6530	0.23
333.150	1343.8293	0.25
338.706	1331.5359	0.05
344.261	1314.0713	0.18
349.817	1300.2045	0.00
355.372	1282.5006	0.00
360.928	1265.2844	-0.10
366.483	1246.5684	-0.18
372.039	1224.6501	-0.11
377.594	1201.6922	-0.10
383.150	1176.1025	-0.02
388.706	1149.9332	-0.09
394.261	1119.3930	-0.01
399.817	1086.7274	-0.03
405.372	1049.7001	-0.04
410.928	1006.1858	0.03
416.483	953.4790	0.14
422.039	885.9761	0.09
427.594	773.0908	0.04
276.350	1483.8040	0.00
279.150	1477.9978	-0.05
283.450	1468.7962	-0.11
285.600	1463.5973	-0.10
285.600	1463.6985	-0.10
288.350	1456.8985	-0.07
288.350	1457.3034	-0.10
290.700	1451.4972	-0.08
290.700	1450.3286	-0.10
293.050	1445.8014	-0.06
293.050	1446.2983	-0.10
294.300	1443.2986	-0.09
294.200	1443.2986	-0.07
295.550	1440.7037	-0.11
295.550	1440.5013	-0.10
298.200	1434.1982	-0.09
298.200	1434.1982	-0.09
300.650	1428.7968	-0.11
300.600	1428.4012	0.08
303.100	1422.8986	-0.10
303.100	1422.5029	-0.07

Temp K	Density kg/m^3	% difference
307.950	1410.8997	-0.06
307.950	1410.5041	-0.03
313.000	1397.4010	0.04
313.050	1397.6034	0.02
318.000	1384.8040	0.08
322.100	1374.4982	0.09
328.550	1356.1962	0.23

Vapor [90]

310.928	6.3590	0.60
316.483	7.8100	0.80
322.039	9.5632	0.74
327.594	11.7094	0.16
331.500	14.2260	-0.09
338.706	17.2186	-0.41
344.261	20.7144	-0.50
349.817	24.8966	-0.83
355.372	29.7134	-0.78
360.928	35.1900	-0.21
366.483	41.9332	-0.50
372.039	49.5621	-0.16
377.594	58.3976	0.34
383.150	69.0451	0.39
388.706	81.5189	0.53
394.261	96.3223	0.62
399.817	114.4992	0.25
405.372	135.8653	0.35
410.928	162.7404	0.15
416.483	197.8316	-0.21
422.039	246.8522	-0.31

Appendix B.

Note: Compositions in the following table have been calculated on the basis of 1 mol/L of pure N_2O_4. Some of the calculated composition for NO and O_2 at the low temperatures were very small negative numbers. Since negative compositions are not realistic, all of the negative compositions were changed to zero.

Table B1. Isobaric tables of N2O4 properties calculated with equations from this work.

0 .101325 MPa Isobsr

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
294.32	15.6872	1440.9879	.0026	91.857327	.998	.003	.000	.000
294.32	.0422	3.3382	.9796	79.157476	.838	.324	.001	.000
295.	.0421	3.3178	.9820	78.866579	.834	.332	.001	.000
300.	.0413	3.1674	.9829	76.638039	.799	.401	.000	.000
305.	.0406	3.0149	.9839	74.239285	.760	.479	.000	.000
310.	.0399	2.8622	.9849	71.710644	.716	.568	.000	.000
315.	.0392	2.7124	.9860	69.126979	.668	.666	.000	.000
320.	.0386	2.5677	.9870	66.548644	.616	.772	.000	.000
325.	.0380	2.4305	.9881	64.042978	.560	.886	.000	.000
330.	.0373	2.2949	.9891	61.463766	.501	1.003	.000	.000
335.	.0367	2.1727	.9900	59.129382	.442	1.121	.000	.000
340.	.0362	2.0642	.9909	57.066001	.384	1.237	.000	.000
345.	.0356	1.9648	.9918	55.163710	.329	1.347	.000	.000
350.	.0351	1.8825	.9926	53.663816	.280	1.451	.000	.000
355.	.0346	1.8136	.9933	52.477137	.236	1.548	.000	.000
360.	.0341	1.7376	.9940	51.022981	.193	1.621	.000	.000
365.	.0336	1.6796	.9947	50.037564	.158	1.689	.000	.000
370.	.0331	1.6294	.9953	49.234989	.129	1.745	.000	.000
375.	.0326	1.5866	.9958	48.615659	.105	1.793	.000	.000
380.	.0322	1.5376	.9963	47.767547	.083	1.814	.019	.010
385.	.0318	1.5107	.9967	47.571548	.069	1.856	.006	.003
390.	.0313	1.4806	.9971	47.248159	.056	1.881	.007	.004
395.	.0309	1.4481	.9975	46.819973	.045	1.890	.020	.010
400.	.0305	1.4279	.9978	46.766869	.037	1.916	.009	.005
405.	.0301	1.4045	.9981	46.587027	.030	1.928	.011	.006
410.	.0298	1.3827	.9984	46.443404	.025	1.938	.012	.006
415.	.0294	1.3620	.9986	46.315740	.021	1.944	.014	.007
420.	.0290	1.3423	.9988	46.207597	.017	1.949	.017	.008
425.	.0287	1.3237	.9990	46.116854	.014	1.953	.019	.009
430.	.0284	1.3056	.9992	46.030454	.012	1.955	.021	.011
435.	.0280	1.2884	.9993	45.955864	.010	1.956	.024	.012
440.	.0277	1.2716	.9994	45.882957	.008	1.956	.027	.014
445.	.0274	1.2553	.9995	45.814625	.007	1.956	.031	.015
450.	.0271	1.2394	.9996	45.747175	.006	1.954	.034	.017
455.	.0268	1.2239	.9997	45.680151	.005	1.952	.038	.019
460.	.0265	1.2087	.9997	45.611741	.004	1.949	.043	.022
465.	.0262	1.1939	.9998	45.543045	.004	1.945	.048	.024
470.	.0259	1.1793	.9998	45.470973	.003	1.941	.053	.027
475.	.0257	1.1649	.9998	45.396878	.003	1.936	.059	.029
480.	.0254	1.1508	.9999	45.318745	.002	1.930	.065	.033
485.	.0251	1.1368	.9999	45.236549	.002	1.924	.072	.036
490.	.0249	1.1231	.9999	45.149877	.002	1.918	.079	.040
495.	.0246	1.1095	.9999	45.058409	.001	1.910	.087	.044
500.	.0244	1.0960	.9999	44.961852	.001	1.902	.095	.048
505.	.0241	1.0827	.9999	44.859899	.001	1.893	.104	.052
510.	.0239	1.0695	.9999	44.752249	.001	1.884	.114	.057
515.	.0237	1.0565	.9999	44.638642	.001	1.874	.124	.062
520.	.0234	1.0435	.9999	44.518879	.001	1.863	.135	.068
525.	.0232	1.0306	.9999	44.392822	.001	1.852	.147	.073
530.	.0230	1.0179	.9999	44.260375	.001	1.840	.159	.079
535.	.0228	1.0052	.9998	44.121480	.000	1.827	.172	.086
540.	.0226	.9926	.9998	43.976115	.000	1.814	.186	.093
545.	.0224	.9801	.9998	43.824246	.000	1.799	.200	.100
550.	.0222	.9677	.9998	43.666111	.000	1.784	.215	.108

0 .2 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.6723	1440.7234	.0052	91.928285	.999	.002	.000	.000
300.	15.5520	1429.5187	.0052	91.918723	.999	.002	.000	.000
305.	15.4304	1418.1253	.0051	91.904565	.999	.002	.000	.000
309.57	15.3173	1407.4464	.0051	91.886236	.999	.003	.000	.000
309.57	.0802	6.1350	.9676	76.502940	.797	.405	.000	.000
310.	.0801	6.1104	.9691	76.315127	.794	.411	.000	.000
315.	.0786	5.8213	.9713	74.045035	.757	.486	.000	.000
320.	.0772	5.5336	.9735	71.663503	.716	.569	.000	.000
325.	.0759	5.2526	.9756	69.238535	.670	.661	.000	.000
330.	.0746	4.9818	.9777	66.818433	.621	.761	.000	.000
335.	.0733	4.7247	.9796	64.458795	.570	.866	.000	.000
340.	.0721	4.4668	.9815	61.967603	.514	.975	.000	.000
345.	.0709	4.2399	.9833	59.790858	.459	1.086	.000	.000
350.	.0698	4.0290	.9849	57.735866	.404	1.195	.000	.000
355.	.0687	3.8421	.9864	55.931776	.352	1.300	.000	.000
360.	.0676	3.6759	.9878	54.343124	.304	1.399	.000	.000
365.	.0666	3.5356	.9891	53.064418	.260	1.492	.000	.000
370.	.0656	3.3958	.9903	51.728039	.218	1.570	.000	.000
375.	.0647	3.2795	.9914	50.686968	.182	1.640	.000	.000
380.	.0638	3.1777	.9924	49.818506	.151	1.700	.000	.000
385.	.0629	3.0812	.9933	48.985591	.124	1.746	.006	.003
390.	.0620	3.0046	.9942	48.429714	.103	1.788	.006	.003
395.	.0612	2.9363	.9949	47.970269	.085	1.824	.006	.003
400.	.0604	2.8746	.9956	47.588843	.070	1.852	.007	.004
405.	.0596	2.8187	.9962	47.274816	.058	1.876	.009	.004
410.	.0589	2.7678	.9967	47.018798	.048	1.894	.010	.005
415.	.0581	2.7165	.9972	46.731990	.039	1.904	.017	.008
420.	.0574	2.6769	.9976	46.625263	.033	1.921	.013	.006
425.	.0567	2.6359	.9979	46.474113	.027	1.930	.015	.007
430.	.0560	2.5970	.9983	46.342311	.023	1.937	.017	.008
435.	.0554	2.5603	.9985	46.230870	.019	1.943	.019	.010
440.	.0547	2.5250	.9988	46.129677	.016	1.946	.022	.011
445.	.0541	2.4913	.9990	46.040340	.014	1.949	.024	.012
450.	.0535	2.4588	.9991	45.957273	.011	1.950	.027	.014
455.	.0529	2.4273	.9993	45.879303	.010	1.950	.031	.015
460.	.0523	2.3968	.9994	45.804847	.008	1.949	.034	.017
465.	.0518	2.3670	.9995	45.732431	.007	1.948	.038	.019
470.	.0512	2.3380	.9996	45.660301	.006	1.946	.042	.021
475.	.0507	2.3096	.9996	45.588869	.005	1.943	.047	.024
480.	.0501	2.2818	.9997	45.515630	.004	1.939	.052	.026
485.	.0496	2.2545	.9997	45.441207	.004	1.935	.057	.029
490.	.0491	2.2277	.9997	45.364021	.003	1.930	.063	.032
495.	.0486	2.2012	.9997	45.283824	.003	1.925	.070	.035
500.	.0481	2.1752	.9997	45.200146	.002	1.919	.076	.038
505.	.0476	2.1495	.9997	45.112622	.002	1.912	.084	.042
510.	.0472	2.1241	.9997	45.021253	.002	1.905	.091	.046
515.	.0467	2.0990	.9997	44.925076	.002	1.897	.100	.050
520.	.0463	2.0742	.9997	44.823905	.001	1.889	.108	.054
525.	.0458	2.0496	.9997	44.717979	.001	1.880	.118	.059
530.	.0454	2.0252	.9997	44.606797	.001	1.870	.128	.064
535.	.0450	2.0010	.9997	44.490194	.001	1.860	.138	.069
540.	.0446	1.9771	.9997	44.368049	.001	1.849	.150	.075
545.	.0442	1.9533	.9997	44.240283	.001	1.837	.161	.081
550.	.0438	1.9297	.9997	44.106844	.001	1.825	.174	.087

0 .4 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.6750	1441.0109	.0104	91.930342	.999	.002	.000	.000
300.	15.5549	1429.8303	.0103	91.921523	.999	.002	.000	.000
305.	15.4335	1418.4666	.0102	91.908383	.999	.002	.000	.000
310.	15.3099	1406.8155	.0101	91.889455	.999	.003	.000	.000
315.	15.1834	1394.7960	.0101	91.863209	.998	.003	.000	.000
320.	15.0536	1382.3457	.0100	91.828193	.998	.004	.000	.000
325.	14.9201	1369.4155	.0099	91.783092	.998	.005	.000	.000
326.66	14.8749	1365.0094	.0098	91.765661	.997	.005	.000	.000
326.66	.1552	11.4096	.9396	73.537856	.749	.503	.000	.000
330.	.1531	11.0307	.9522	72.049573	.723	.555	.000	.000
335.	.1501	10.4774	.9565	69.785211	.681	.640	.000	.000
340.	.1473	9.9393	.9606	67.472509	.635	.731	.000	.000
345.	.1446	9.4247	.9643	65.174830	.587	.828	.000	.000
350.	.1420	8.9386	.9678	62.937690	.537	.928	.000	.000
355.	.1396	8.4852	.9711	60.803470	.486	1.031	.000	.000
360.	.1372	8.0678	.9741	58.808040	.434	1.133	.000	.000
365.	.1349	7.6920	.9769	57.008889	.385	1.234	.000	.000
370.	.1328	7.3539	.9794	55.392879	.337	1.329	.000	.000
375.	.1307	7.0521	.9817	53.965072	.293	1.419	.000	.000
380.	.1287	6.8054	.9838	52.884958	.254	1.505	.000	.000
385.	.1268	6.5415	.9858	51.602648	.215	1.574	.000	.000
390.	.1249	6.3110	.9875	50.519107	.181	1.634	.004	.002
395.	.1231	6.1249	.9890	49.736484	.152	1.690	.005	.003
400.	.1214	5.9608	.9904	49.086007	.128	1.738	.006	.003
405.	.1198	5.8098	.9917	48.500783	.107	1.776	.009	.005
410.	.1182	5.6837	.9928	48.088350	.090	1.812	.008	.004
415.	.1167	5.5657	.9938	47.711055	.076	1.840	.009	.004
420.	.1152	5.4581	.9946	47.393731	.063	1.863	.010	.005
425.	.1137	5.3596	.9954	47.128437	.053	1.882	.011	.006
430.	.1123	5.2685	.9961	46.904270	.045	1.897	.013	.007
435.	.1110	5.1839	.9966	46.714624	.038	1.910	.015	.007
440.	.1097	5.1046	.9971	46.551841	.032	1.920	.017	.008
445.	.1084	5.0298	.9976	46.410913	.027	1.927	.019	.010
450.	.1071	4.9589	.9979	46.287203	.023	1.933	.021	.011
455.	.1059	4.8912	.9982	46.177119	.019	1.937	.024	.012
460.	.1047	4.8264	.9985	46.077568	.016	1.940	.027	.013
465.	.1036	4.7641	.9987	45.986029	.014	1.942	.030	.015
470.	.1025	4.7038	.9988	45.900484	.012	1.942	.033	.017
475.	.1014	4.6455	.9990	45.819185	.010	1.942	.037	.019
480.	.1003	4.5887	.9991	45.740444	.009	1.941	.041	.021
485.	.0993	4.5335	.9992	45.663690	.008	1.939	.046	.023
490.	.0983	4.4794	.9992	45.587145	.007	1.937	.050	.025
495.	.0973	4.4266	.9992	45.510561	.006	1.933	.055	.028
500.	.0963	4.3747	.9993	45.432761	.005	1.929	.061	.030
505.	.0953	4.3238	.9993	45.353233	.004	1.925	.066	.033
510.	.0944	4.2737	.9993	45.271416	.004	1.920	.073	.036
515.	.0935	4.2243	.9993	45.187078	.003	1.914	.079	.040
520.	.0926	4.1756	.9993	45.099480	.003	1.908	.086	.043
525.	.0917	4.1276	.9992	45.008391	.003	1.901	.094	.047
530.	.0908	4.0800	.9992	44.913501	.002	1.894	.102	.051
535.	.0900	4.0330	.9992	44.814545	.002	1.886	.110	.055
540.	.0892	3.9865	.9992	44.711299	.002	1.877	.119	.060
545.	.0883	3.9404	.9992	44.603538	.002	1.868	.129	.065
550.	.0875	3.8946	.9993	44.491203	.001	1.858	.139	.070

0.6 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.6778	1441.6680	.0156	91.955991	.999	.001	.000	.000
300.	15.5578	1430.4299	.0155	91.942832	.999	.002	.000	.000
305.	15.4366	1418.7705	.0153	91.909789	.999	.002	.000	.000
310.	15.3131	1407.1429	.0152	91.891392	.999	.003	.000	.000
315.	15.1868	1395.1512	.0151	91.865883	.998	.003	.000	.000
320.	15.0572	1382.7346	.0150	91.831920	.998	.004	.000	.000
325.	14.9240	1369.8457	.0149	91.788302	.998	.005	.000	.000
330.	14.7868	1356.4473	.0148	91.733842	.997	.006	.000	.000
335.	14.6454	1342.4968	.0147	91.667056	.996	.007	.000	.000
337.43	14.5749	1335.4228	.0146	91.624617	.996	.008	.000	.000
337.43	.2291	16.4358	.9265	71.747072	.717	.566	.000	.000
340.	.2265	16.0006	.9369	70.630881	.697	.608	.000	.000
345.	.2218	15.1737	.9431	68.412128	.654	.693	.000	.000
350.	.2173	14.3848	.9488	66.192568	.609	.783	.000	.000
355.	.2131	13.6398	.9540	64.012791	.562	.878	.000	.000
360.	.2091	12.9434	.9588	61.911626	.513	.976	.000	.000
365.	.2053	12.2995	.9632	59.923214	.464	1.074	.000	.000
370.	.2016	11.7159	.9673	58.103422	.415	1.172	.000	.000
375.	.1982	11.1805	.9709	56.410605	.368	1.266	.000	.000
380.	.1949	10.7048	.9743	54.918096	.323	1.356	.000	.000
385.	.1918	10.2887	.9773	53.642897	.282	1.440	.000	.000
390.	.1888	9.9715	.9800	52.810360	.248	1.523	.000	.000
395.	.1860	9.5352	.9824	51.274717	.208	1.580	.005	.002
400.	.1832	9.2371	.9846	50.412475	.177	1.640	.005	.003
405.	.1806	8.9752	.9866	49.693700	.151	1.693	.005	.003
410.	.1781	8.7391	.9883	49.070213	.128	1.737	.007	.003
415.	.1757	8.5293	.9899	48.552007	.108	1.776	.007	.004
420.	.1733	8.3397	.9912	48.110951	.092	1.808	.009	.004
425.	.1711	8.1685	.9924	47.742234	.078	1.835	.010	.005
430.	.1689	8.0123	.9935	47.430144	.066	1.858	.011	.006
435.	.1668	7.8689	.9944	47.166067	.055	1.876	.013	.006
440.	.1648	7.7362	.9952	46.940741	.047	1.891	.015	.007
445.	.1628	7.6129	.9958	46.748869	.040	1.904	.016	.008
450.	.1609	7.4971	.9964	46.582479	.034	1.914	.019	.009
455.	.1591	7.3881	.9969	46.437512	.029	1.921	.021	.010
460.	.1573	7.2846	.9973	46.309491	.025	1.927	.023	.012
465.	.1556	7.1860	.9976	46.194790	.021	1.932	.026	.013
470.	.1539	7.0916	.9979	46.090771	.018	1.935	.029	.015
475.	.1522	7.0009	.9981	45.994891	.016	1.937	.032	.016
480.	.1506	6.9132	.9983	45.905189	.013	1.937	.036	.018
485.	.1490	6.8283	.9984	45.819921	.012	1.937	.040	.020
490.	.1475	6.7459	.9985	45.737853	.010	1.936	.044	.022
495.	.1460	6.6656	.9986	45.657573	.009	1.934	.048	.024
500.	.1445	6.5871	9987	45.578273	.008	1.932	.053	.026
505.	.1431	6.5104	.9987	45.498946	.007	1.929	.058	.029
510.	.1417	6.4351	.9987	45.418892	.006	1.925	.063	.032
515.	.1403	6.3612	.9987	45.337463	.005	1.921	.069	.035
520.	.1390	6.2885	.9987	45.254281	.004	1.916	.075	.038
525.	.1376	6.2168	.9987	45.168669	.004	1.910	.082	.041
530.	.1363	6.1461	.9987	45.080300	.003	1.904	.089	.045
535.	.1351	6.0763	.9987	44.988821	.003	1.897	.097	.048
540.	.1338	6.0073	.9987	44.893932	.003	1.890	.105	.052
545.	.1326	5.9390	.9987	44.795373	.002	1.882	.113	.056
550.	.1314	5.8714	.9987	44.692926	.002	1.874	.122	.061

0.8 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.6806	1441.9289	.0208	91.956366	.999	.001	.000	.000
300.	15.5607	1430.7060	.0206	91.943365	.999	.002	.000	.000
305.	15.4396	1419.2964	.0204	91.925586	.999	.002	.000	.000
310.	15.3163	1407.4574	.0203	91.892505	.999	.003	.000	.000
315.	15.1902	1395.4889	.0201	91.867423	.998	.003	.000	.000
320.	15.0609	1383.0990	.0200	91.834049	.998	.004	.000	.000
325.	14.9278	1370.2416	.0198	91.791247	.998	.005	.000	.000
330.	14.7908	1356.8810	.0197	91.737915	.997	.006	.000	.000
335.	14.6497	1342.9760	.0196	91.672676	.996	.007	.000	.000
340.	14.5041	1328.4357	.0195	91.590588	.995	.009	.000	.000
345.	14.3536	1313.3181	.0194	91.497350	.994	.011	.000	.000
345.45	14.3399	1311.9339	.0192	91.488063	.994	.011	.000	.000
345.45	.3028	21.3388	.9080	70.479573	.694	.613	.000	.000
350.	.2964	20.3083	.9275	68.513191	.656	.689	.000	.000
355.	.2899	19.2353	.9350	66.355909	.613	.777	.000	.000
360.	.2838	18.2275	.9419	64.234637	.567	.868	.000	.000
365.	.2780	17.2890	.9482	62.185061	.519	.963	.000	.000
370.	.2726	16.4228	.9539	60.238550	.472	1.058	.000	.000
375.	.2675	15.6298	.9590	58.419082	.424	1.152	.000	.000
380.	.2627	14.9173	.9637	56.774836	.379	1.245	.000	.000
385.	.2582	14.2392	.9679	55.147099	.333	1.331	.003	.002
390.	.2539	13.7022	.9717	53.967375	.294	1.415	.000	.000
395.	.2498	13.2034	.9751	52.853880	.256	1.492	.000	.000
400.	.2459	12.7361	.9782	51.790114	.222	1.560	.000	.000
405.	.2422	12.2538	.9809	50.592277	.187	1.613	.012	.006
410.	.2387	11.9297	.9833	49.985223	.162	1.670	.006	.003
415.	.2353	11.6083	.9855	49.339107	.138	1.717	.007	.003
420.	.2320	11.3212	.9874	48.792412	.118	1.757	.008	.004
425.	.2289	11.0628	.9890	48.327811	.100	1.791	.009	.004
430.	.2259	10.8290	.9905	47.933955	.085	1.819	.010	.005
435.	.2230	10.6163	.9918	47.599755	.073	1.843	.011	.006
440.	.2203	10.4213	.9929	47.315279	.062	1.863	.013	.007
445.	.2176	10.2417	.9938	47.072985	.053	1.880	.015	.007
450.	.2150	10.0747	.9946	46.864377	.045	1.894	.017	.008
455.	.2125	9.9189	.9953	46.684331	.038	1.905	.019	.009
460.	.2100	9.7723	.9959	46.526835	.033	1.913	.021	.011
465.	.2077	9.6337	.9964	46.387885	.028	1.920	.024	.012
470.	.2054	9.5019	.9968	46.263735	.024	1.925	.026	.013
475.	.2032	9.3761	.9971	46.151702	.021	1.929	.029	.015
480.	.2010	9.2553	.9974	46.048902	.018	1.932	.032	.016
485.	.1989	9.1391	.9976	45.953326	.016	1.933	.036	.018
490.	.1968	9.0266	.9977	45.863126	.013	1.933	.040	.020
495.	.1948	8.9177	.9978	45.776969	.012	1.933	.044	.022
500.	.1928	8.8116	.9979	45.693376	.010	1.932	.048	.024
505.	.1909	8.7082	.9980	45.611450	.009	1.930	.053	.026
510.	.1890	8.6072	.9980	45.530142	.008	1.927	.058	.029
515.	.1872	8.5082	.9980	45.448701	.007	1.924	.063	.031
520.	.1854	8.4110	.9980	45.366435	.006	1.920	.069	.034
525.	.1836	8.3154	.9980	45.282909	.005	1.915	.075	.037
530.	.1819	8.2214	.9981	45.197446	.005	1.910	.081	.040
535.	.1802	8.1286	.9981	45.109680	.004	1.904	.088	.044
540.	.1785	8.0370	.9981	45.019238	.004	1.898	.095	.048
545.	.1769	7.9465	.9981	44.925800	.003	1.891	.103	.051
550.	.1753	7.8569	.9982	44.829089	.003	1.884	.111	.055

1.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.6833	1442.1882	.0260	91.956647	.999	.001	.000	.000
300.	15.5636	1430.9799	.0258	91.943767	.999	.002	.000	.000
305.	15.4427	1419.5869	.0255	91.926149	.999	.002	.000	.000
310.	15.3196	1407.9174	.0253	91.903130	.999	.002	.000	.000
315.	15.1937	1395.8193	.0251	91.868506	.998	.003	.000	.000
320.	15.0645	1383.4534	.0249	91.835536	.998	.004	.000	.000
325.	14.9316	1370.6234	.0248	91.793284	.998	.005	.000	.000
330.	14.7949	1357.2950	.0246	91.740696	.997	.006	.000	.000
335.	14.6540	1343.4277	.0245	91.676464	.996	.007	.000	.000
340.	14.5087	1328.9770	.0244	91.598813	.996	.009	.000	.000
345.	14.3586	1313.8722	.0243	91.504329	.995	.011	.000	.000
350.	14.2032	1298.0781	.0242	91.393215	.993	.013	.000	.000
351.88	14.1432	1291.9231	.0240	91.345759	.993	.014	.000	.000
351.88	.3766	26.1667	.8996	69.482784	.675	.651	.000	.000
355.	.3707	25.2669	.9139	68.155821	.649	.702	.000	.000
360.	.3619	23.9029	.9232	66.048972	.606	.788	.000	.000
365.	.3537	22.6323	.9316	63.983275	.561	.878	.000	.000
370.	.3461	21.4564	.9392	61.990451	.515	.971	.000	.000
375.	.3390	20.3750	.9460	60.096049	.469	1.064	.000	.000
380.	.3324	19.3657	.9522	58.257780	.421	1.155	.002	.001
385.	.3262	18.4732	.9577	56.631745	.377	1.244	.003	.001
390.	.3204	17.5174	.9627	54.681738	.328	1.324	.021	.010
395.	.3148	16.9077	.9671	53.702399	.292	1.407	.010	.005
400.	.3096	16.3879	.9711	52.927243	.259	1.487	.000	.000
405.	.3047	15.7516	.9747	51.696635	.223	1.550	.005	.003
410.	.3000	15.2516	.9778	50.837519	.193	1.610	.005	.003
415.	.2955	14.8028	.9806	50.086055	.166	1.663	.006	.003
420.	.2913	14.4020	.9831	49.441445	.142	1.709	.007	.003
425.	.2872	14.0428	.9853	48.889966	.122	1.748	.008	.004
430.	.2833	13.7166	.9872	48.409643	.104	1.782	.010	.005
435.	.2796	13.4273	.9888	48.020364	.089	1.812	.010	.005
440.	.2760	13.1613	.9903	47.679615	.076	1.836	.012	.006
445.	.2726	12.9175	.9915	47.387872	.065	1.856	.014	.007
450.	.2693	12.6932	.9926	47.138781	.056	1.873	.015	.008
455.	.2661	12.4849	.9935	46.923369	.048	1.887	.017	.009
460.	.2630	12.2905	.9943	46.736512	.041	1.899	.019	.010
465.	.2600	12.1079	.9949	46.573063	.035	1.908	.022	.011
470.	.2571	11.9355	.9954	46.428281	.030	1.915	.024	.012
475.	.2543	11.7718	.9959	46.299314	.026	1.921	.027	.013
480.	.2515	11.6157	.9962	46.182486	.023	1.925	.030	.015
485.	.2489	11.4661	.9965	46.075515	.020	1.928	.033	.017
490.	.2463	11.3221	.9967	45.976222	.017	1.930	.037	.018
495.	.2437	11.1830	.9969	45.882680	.015	1.930	.040	.020
500.	.2413	11.0483	.9970	45.793696	.013	1.930	.044	.022
505.	.2389	10.9173	.9971	45.707596	.011	1.929	.049	.024
510.	.2365	10.7897	.9972	45.623573	.010	1.927	.053	.027
515.	.2342	10.6650	.9972	45.540497	.009	1.925	.058	.029
520.	.2319	10.5428	.9973	45.457619	.008	1.921	.063	.032
525.	.2297	10.4230	.9973	45.374306	.007	1.918	.069	.035
530.	.2275	10.3051	.9973	45.289903	.006	1.913	.075	.038
535.	.2254	10.1891	.9974	45.203923	.005	1.908	.081	.041
540.	.2233	10.0747	.9974	45.115923	.005	1.903	.088	.044
545.	.2212	9.9618	.9975	45.025525	.004	1.897	.095	.048
550.	.2192	9.8501	.9975	44.932399	.004	1.890	.103	.051

1.5 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.6903	1442.8332	.0390	91.957165	.999	.001	.000	.000
300.	15.5709	1431.6604	.0386	91.944530	.999	.002	.000	.000
305.	15.4503	1420.3070	.0383	91.927213	.999	.002	.000	.000
310.	15.3277	1408.6815	.0380	91.904578	.999	.002	.000	.000
315.	15.2022	1396.7168	.0377	91.876024	.998	.003	.000	.000
320.	15.0735	1384.3205	.0374	91.838118	.998	.004	.000	.000
325.	14.9412	1371.5533	.0372	91.796774	.998	.005	.000	.000
330.	14.8050	1358.2937	.0369	91.745374	.997	.006	.000	.000
335.	14.6648	1344.5065	.0367	91.682711	.996	.007	.000	.000
340.	14.5202	1330.1514	.0365	91.607134	.996	.009	.000	.000
345.	14.3709	1315.1548	.0364	91.515401	.995	.011	.000	.000
350.	14.2164	1299.4912	.0363	91.407866	.993	.013	.000	.000
355.	14.0562	1283.0370	.0362	91.279054	.992	.016	.000	.000
360.	13.8895	1265.6863	.0361	91.125606	.990	.019	.000	.000
364.09	13.7474	1250.7191	.0360	90.978912	.989	.022	.001	.000
364.09	.5632	38.1505	.8777	67.742207	.641	.719	.000	.000
365.	.5601	37.7243	.8825	67.355894	.634	.734	.000	.000
370.	.5441	35.5561	.8961	65.344964	.591	.818	.000	.000
375.	.5298	33.7115	.9081	63.635454	.551	.905	.000	.000
380.	.5167	31.6828	.9188	61.316399	.501	.993	.004	.002
385.	.5048	30.1125	.9283	59.654272	.458	1.082	.002	.001
390.	.4938	28.6427	.9368	58.001775	.415	1.169	.002	.001
395.	.4837	27.3203	.9443	56.481964	.372	1.254	.002	.001
400.	.4743	26.1307	.9509	55.092248	.331	1.334	.003	.002
405.	.4656	25.0741	.9568	53.858038	.293	1.410	.003	.002
410.	.4574	24.1978	.9621	52.905483	.260	1.483	.000	.000
415.	.4497	23.2899	.9667	51.789401	.226	1.544	.005	.002
420.	.4425	22.5398	.9708	50.939491	.197	1.601	.006	.003
425.	.4357	21.8723	.9744	50.204688	.171	1.652	.007	.003
430.	.4292	21.2761	.9775	49.570452	.148	1.697	.008	.004
435.	.4231	20.7411	.9803	49.023648	.127	1.736	.009	.004
440.	.4173	20.2593	.9827	48.553693	.110	1.770	.010	.005
445.	.4117	19.8230	.9848	48.149590	.095	1.799	.011	.006
450.	.4064	19.4259	.9865	47.802004	.082	1.824	.013	.007
455.	.4013	19.0623	.9881	47.502516	.070	1.845	.015	.007
460.	.3964	18.7275	.9894	47.243589	.061	1.862	.017	.008
465.	.3917	18.4171	.9905	47.018438	.052	1.877	.019	.009
470.	.3872	18.1280	.9914	46.822153	.045	1.889	.021	.010
475.	.3828	17.8570	.9922	46.649224	.039	1.899	.023	.012
480.	.3786	17.6014	.9929	46.495654	.034	1.906	.026	.013
485.	.3745	17.3591	.9934	46.358096	.029	1.913	.029	.014
490.	.3705	17.1285	.9938	46.233466	.026	1.917	.032	.016
495.	.3666	16.9077	.9942	46.119288	.022	1.921	.035	.017
500.	.3628	16.6957	.9944	46.013410	.019	1.923	.038	.019
505.	.3592	16.4911	.9946	45.914074	.017	1.924	.042	.021
510.	.3556	16.2930	.9948	45.819677	.015	1.924	.046	.023
515.	.3521	16.1007	.9950	45.728965	.013	1.923	.051	.025
520.	.3487	15.9133	.9951	45.640778	.011	1.922	.055	.028
525.	.3453	15.7303	.9952	45.554168	.010	1.920	.060	.030
530.	.3420	15.5511	.9953	45.468299	.009	1.917	.065	.033
535.	.3388	15.3753	.9953	45.382544	.008	1.913	.071	.035
540.	.3356	15.2024	.9955	45.296202	.007	1.909	.077	.038
545.	.3325	15.0321	.9956	45.208781	.006	1.904	.083	.042
550.	.3294	14.8641	.9957	45.119829	.006	1.899	.090	.045

2.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.6972	1443.4760	.0519	91.957570	.999	.001	.000	.000
300.	15.5782	1432.3376	.0515	91.945137	.999	.002	.000	.000
305.	15.4580	1421.0227	.0510	91.928070	.999	.002	.000	.000
310.	15.3357	1409.4395	.0506	91.905732	.999	.002	.000	.000
315.	15.2107	1397.5212	.0502	91.877543	.998	.003	.000	.000
320.	15.0825	1385.1751	.0498	91.840051	.998	.004	.000	.000
325.	14.9507	1372.4651	.0495	91.799336	.998	.005	.000	.000
330.	14.8151	1359.2692	.0492	91.748733	.997	.006	.000	.000
335.	14.6755	1345.5535	.0489	91.687093	.996	.007	.000	.000
340.	14.5316	1331.2805	.0487	91.612836	.996	.009	.000	.000
345.	14.3831	1316.3781	.0485	91.522793	.995	.011	.000	.000
350.	14.2295	1300.8248	.0483	91.417473	.994	.013	.000	.000
355.	14.0703	1284.5008	.0482	91.291494	.992	.015	.000	.000
360.	13.9048	1267.3064	.0481	91.141682	.991	.019	.000	.000
365.	13.7317	1249.0908	.0480	90.964106	.989	.022	.000	.000
370.	13.5495	1229.6755	.0480	90.753978	.986	.027	.001	.000
373.17	13.4286	1216.6527	.0478	90.601381	.985	.030	.001	.000
373.17	.7543	50.1946	.8504	66.547035	.617	.766	.000	.000
375.	.7446	49.0255	.8615	65.838819	.602	.796	.000	.000
380.	.7207	46.0186	.8783	63.852596	.559	.880	.001	.001
385.	.6996	43.3827	.8931	62.008594	.517	.965	.001	.001
390.	.6808	41.0216	.9059	60.251390	.474	1.051	.002	.001
395.	.6639	38.9117	.9172	58.607262	.431	1.136	.002	.001
400.	.6486	37.0245	.9272	57.082739	.389	1.219	.002	.001
405.	.6346	35.3423	.9359	55.691025	.349	1.299	.003	.001
410.	.6218	33.8406	.9436	54.427570	.311	1.374	.004	.002
415.	.6099	32.5050	.9504	53.297536	.276	1.444	.004	.002
420.	.5989	31.5579	.9564	52.696736	.248	1.517	.000	.000
425.	.5886	30.2593	.9616	51.409863	.213	1.568	.006	.003
430.	.5790	29.3208	.9662	50.641949	.186	1.620	.007	.003
435.	.5700	28.4815	.9702	49.970867	.162	1.667	.008	.004
440.	.5615	27.7285	.9737	49.386251	.141	1.709	.009	.004
445.	.5534	27.0515	.9767	48.880034	.123	1.745	.010	.005
450.	.5458	26.4402	.9794	48.442253	.106	1.776	.012	.006
455.	.5386	25.8854	.9816	48.063595	.092	1.803	.013	.007
460.	.5317	25.3793	.9836	47.735823	.080	1.826	.015	.007
465.	.5251	24.9147	.9852	47.451232	.069	1.845	.017	.008
470.	.5187	24.4860	.9866	47.203381	.060	1.861	.019	.009
475.	.5127	24.0880	.9878	46.986316	.052	1.875	.021	.010
480.	.5068	23.7164	.9888	46.795314	.045	1.886	.023	.012
485.	.5012	23.3674	.9896	46.625792	.039	1.896	.026	.013
490.	.4957	23.0379	.9903	46.474256	.034	1.903	.028	.014
495.	.4904	22.7252	.9909	46.337448	.030	1.909	.031	.016
500.	.4853	22.4270	.9913	46.212714	.026	1.913	.035	.017
505.	.4803	22.1414	.9917	46.097748	.023	1.916	.038	.019
510.	.4755	21.8666	.9920	45.990628	.020	1.918	.042	.021
515.	.4707	21.6011	.9923	45.889644	.018	1.919	.046	.023
520.	.4661	21.3439	.9925	45.793403	.016	1.919	.050	.025
525.	.4616	21.0937	.9927	45.700659	.014	1.918	.054	.027
530.	.4571	20.8497	.9929	45.610371	.012	1.917	.059	.030
535.	.4528	20.6110	.9930	45.521627	.011	1.914	.064	.032
540.	.4485	20.3769	.9932	45.433710	.009	1.911	.070	.035
545.	.4443	20.1470	.9934	45.345886	.008	1.908	.075	.038
550.	.4402	19.9205	.9936	45.257604	.007	1.904	.081	.041

3.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.7110	1444.7583	.0779	91.958279	.999	.001	.000	.000
300.	15.5927	1433.6867	.0771	91.946177	.999	.002	.000	.000
305.	15.4732	1422.4465	.0765	91.929533	.999	.002	.000	.000
310.	15.3518	1410.9454	.0758	91.907702	.999	.002	.000	.000
315.	15.2276	1399.1167	.0752	91.880113	.999	.003	.000	.000
320.	15.1004	1386.9094	.0747	91.846066	.998	.004	.000	.000
325.	14.9696	1374.2649	.0742	91.803478	.998	.005	.000	.000
330.	14.8352	1361.1887	.0737	91.754075	.997	.006	.000	.000
335.	14.6968	1347.6084	.0733	91.693919	.997	.007	.000	.000
340.	14.5543	1333.4842	.0729	91.621530	.996	.008	.000	.000
345.	14.4073	1318.7678	.0726	91.534966	.995	.010	.000	.000
350.	14.2554	1303.3951	.0723	91.431504	.994	.013	.000	.000
355.	14.0983	1287.3049	.0721	91.309299	.992	.015	.000	.000
360.	13.9350	1270.3789	.0719	91.164309	.991	.018	.000	.000
365.	13.7647	1252.4909	.0718	90.992783	.989	.022	.000	.000
370.	13.5859	1233.4685	.0718	90.790288	.987	.026	.000	.000
375.	13.3968	1213.0976	.0718	90.551383	.984	.031	.000	.000
380.	13.1945	1191.0705	.0720	90.270154	.981	.037	.001	.000
385.	12.9751	1166.9643	.0722	89.938573	.977	.045	.001	.000
386.57	12.9020	1158.8981	.0717	89.822986	.976	.047	.001	.000
386.57	1.1554	75.0995	.8007	64.997429	.585	.829	.001	.001
390.	1.1199	71.3879	.8261	63.744765	.557	.885	.001	.001
395.	1.0760	66.6890	.8490	61.979408	.516	.966	.002	.001
400.	1.0389	62.6492	.8683	60.302769	.475	1.048	.002	.001
405.	1.0069	59.1335	.8848	58.725980	.434	1.129	.002	.001
410.	.9789	56.0546	.8990	57.261377	.394	1.208	.003	.001
415.	.9541	53.3470	.9113	55.915439	.356	1.285	.003	.002
420.	.9318	50.9587	.9220	54.689776	.319	1.357	.004	.002
425.	.9116	48.8499	.9313	53.585677	.285	1.425	.005	.002
430.	.8933	46.9740	.9394	52.587177	.253	1.488	.006	.003
435.	.8764	45.3299	.9464	51.721720	.224	1.545	.006	.003
440.	.8609	43.8608	.9526	50.948313	.198	1.598	.007	.004
445.	.8465	42.5499	.9579	50.266384	.174	1.644	.008	.004
450.	.8331	41.3788	.9625	49.670096	.152	1.686	.010	.005
455.	.8205	40.3271	.9665	49.148310	.133	1.723	.011	.005
460.	.8087	39.3794	.9699	48.693160	.116	1.755	.012	.006
465.	.7976	38.5209	.9729	48.295874	.102	1.782	.014	.007
470.	.7871	37.7394	.9754	47.949145	.089	1.807	.016	.008
475.	.7771	37.0243	.9776	47.646107	.078	1.827	.018	.009
480.	.7675	36.3660	.9794	47.380143	.068	1.845	.020	.010
485.	.7584	35.7568	.9809	47.146078	.059	1.860	.022	.011
490.	.7497	35.1895	.9822	46.938890	.052	1.872	.024	.012
495.	.7413	34.6584	.9833	46.754528	.045	1.882	.027	.013
500.	.7332	34.1584	.9843	46.589248	.040	1.891	.030	.015
505.	.7253	33.6852	.9850	46.439969	.035	1.897	.033	.016
510.	.7178	33.2350	.9857	46.303932	.031	1.903	.036	.018
515.	.7104	32.8046	.9863	46.178760	.027	1.907	.039	.020
520.	.7032	32.3913	.9868	46.062577	.024	1.909	.043	.021
525.	.6962	31.9926	.9872	45.953508	.021	1.911	.047	.023
530.	.6893	31.6066	.9876	45.850165	.019	1.912	.051	.026
535.	.6826	31.2314	.9880	45.751212	.017	1.911	.055	.028
540.	.6761	30.8655	.9884	45.655559	.015	1.911	.060	.030
545.	.6696	30.5077	.9888	45.562274	.013	1.909	.065	.033
550.	.6632	30.1567	.9892	45.470515	.012	1.906	.070	.035

4.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.7248	1446.1294	.1037	91.964755	.999	.001	.000	.000
300.	15.6071	1435.0311	.1028	91.947128	.999	.001	.000	.000
305.	15.4884	1423.8634	.1018	91.930850	.999	.002	.000	.000
310.	15.3678	1412.4419	.1010	91.909461	.999	.002	.000	.000
315.	15.2445	1400.6999	.1002	91.882397	.999	.003	.000	.000
320.	15.1182	1388.5871	.0994	91.848977	.998	.004	.000	.000
325.	14.9884	1376.0441	.0988	91.807036	.998	.005	.000	.000
330.	14.8551	1363.0824	.0981	91.758649	.997	.006	.000	.000
335.	14.7179	1349.6285	.0976	91.699689	.997	.007	.000	.000
340.	14.5767	1335.6452	.0971	91.628763	.996	.008	.000	.000
345.	14.4312	1321.0876	.0966	91.544014	.995	.010	.000	.000
350.	14.2810	1305.8959	.0963	91.442779	.994	.012	.000	.000
355.	14.1258	1290.0164	.0959	91.323411	.992	.015	.000	.000
360.	13.9648	1273.3360	.0957	91.181921	.991	.018	.000	.000
365.	13.7971	1255.7394	.0955	91.014757	.989	.022	.000	.000
370.	13.6215	1237.0720	.0955	90.817696	.987	.026	.000	.000
375.	13.4362	1217.1282	.0955	90.585557	.984	.031	.000	.000
380.	13.2389	1195.6414	.0956	90.312782	.981	.037	.000	.000
385.	13.0260	1172.2320	.0959	89.991781	.978	.044	.001	.000
390.	12.7923	1146.3642	.0964	89.613954	.974	.052	.001	.000
395.	12.5293	1117.2205	.0972	89.168751	.969	.062	.001	.001
396.52	12.4416	1107.5225	.0967	89.018020	.967	.065	.001	.001
396.52	1.5894	101.8788	.7567	64.099244	.565	.868	.001	.001
400.	1.5251	95.9121	.7886	62.887277	.538	.923	.002	.001
405.	1.4515	88.7775	.8184	61.164586	.497	1.003	.003	.002
410.	1.3923	83.0160	.8428	59.625361	.458	1.082	.002	.001
415.	1.3431	78.0906	.8631	58.142832	.419	1.160	.003	.001
420.	1.3011	73.8608	.8804	56.766910	.381	1.235	.003	.002
425.	1.2647	70.1976	.8951	55.505788	.344	1.308	.004	.002
430.	1.2326	67.0052	.9077	54.360981	.310	1.376	.005	.002
435.	1.2040	64.2052	.9186	53.326659	.277	1.440	.005	.003
440.	1.1783	61.7404	.9280	52.399376	.247	1.499	.006	.003
445.	1.1549	59.5631	.9361	51.573209	.219	1.554	.007	.004
450.	1.1336	57.6327	.9431	50.840684	.194	1.603	.008	.004
455.	1.1140	55.9148	.9492	50.193718	.172	1.647	.010	.005
460.	1.0958	54.3797	.9544	49.623928	.151	1.687	.011	.005
465.	1.0790	53.0024	.9589	49.123422	.133	1.722	.012	.006
470.	1.0632	51.7605	.9628	48.683767	.117	1.752	.014	.007
475.	1.0484	50.6357	.9661	48.298200	.103	1.779	.016	.008
480.	1.0344	49.6109	.9689	47.959167	.090	1.802	.017	.009
485.	1.0212	48.6728	.9713	47.661064	.079	1.822	.019	.010
490.	1.0087	47.8087	.9734	47.397816	.069	1.839	.022	.011
495.	.9967	47.0084	.9751	47.164667	.061	1.854	.024	.012
500.	.9852	46.2628	.9766	46.957131	.054	1.866	.026	.013
505.	.9742	45.5643	.9779	46.771358	.047	1.876	.029	.015
510.	.9636	44.9061	.9790	46.604001	.042	1.885	.032	.016
515.	.9533	44.2827	.9799	46.452111	.037	1.891	.035	.018
520.	.9433	43.6889	.9808	46.313127	.032	1.897	.039	.019
525.	.9337	43.1205	.9815	46.184901	.029	1.901	.042	.021
530.	.9242	42.5740	.9822	46.065466	.025	1.903	.046	.023
535.	.9150	42.0461	.9828	45.953217	.023	1.905	.050	.025
540.	.9059	41.5340	.9834	45.846704	.020	1.906	.054	.027
545.	.8971	41.0355	.9840	45.744702	.018	1.906	.059	.029
550.	.8883	40.5484	.9847	45.646136	.016	1.905	.063	.032

5.0 MPa Isobor

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		moss	N2O4	NO2	NO	O2
295.	15.7386	1447.4097	.1295	91.965562	.999	.001	.000	.000
300.	15.6216	1436.4257	.1283	91.951489	.999	.001	.000	.000
305.	15.5036	1425.2747	.1272	91.932097	.999	.002	.000	.000
310.	15.3837	1413.9307	.1261	91.911112	.999	.002	.000	.000
315.	15.2613	1402.2731	.1251	91.884526	.999	.003	.000	.000
320.	15.1358	1390.2523	.1242	91.851681	.998	.004	.000	.000
325.	15.0071	1377.8278	.1233	91.811657	.998	.004	.000	.000
330.	14.8748	1364.9564	.1225	91.762831	.997	.005	.000	.000
335.	14.7388	1351.6243	.1218	91.704950	.997	.007	.000	.000
340.	14.5989	1337.7761	.1212	91.635314	.996	.008	.000	.000
345.	14.4548	1323.3700	.1206	91.552138	.995	.010	.000	.000
350.	14.3063	1308.3591	.1201	91.453217	.994	.012	.000	.000
355.	14.1529	1292.6687	.1197	91.335848	.993	.015	.000	.000
360.	13.9940	1276.2184	.1194	91.197302	.991	.018	.000	.000
365.	13.8289	1258.8930	.1191	91.033769	.989	.021	.000	.000
370.	13.6563	1240.5501	.1190	90.841192	.987	.025	.000	.000
375.	13.4747	1221.0011	.1190	90.614588	.985	.030	.000	.000
380.	13.2819	1200.0048	.1192	90.348639	.982	.036	.000	.000
385.	13.0750	1177.2231	.1195	90.036258	.978	.043	.000	.000
390.	12.8493	1152.1840	.1200	89.669126	.974	.051	.001	.000
395.	12.5978	1124.1901	.1209	89.237334	.969	.061	.001	.000
400.	12.3086	1092.1163	.1221	88.728242	.963	.072	.001	.001
404.50	11.9977	1058.0860	.1238	88.190543	.957	.084	.001	.001
404.50	2.0678	131.3693	.7181	63.531909	.552	.894	.002	.001
405.	2.0500	129.9226	.7243	63.375752	.549	.901	.002	.001
410.	1.9072	117.6719	.7690	61.697303	.510	.979	.002	.001
415.	1.8047	108.4940	.8029	60.117167	.471	1.056	.002	.001
420.	1.7250	101.1392	.8301	58.632066	.432	1.133	.003	.001
425.	1.6601	95.0427	.8524	57.252220	.395	1.207	.003	.002
430.	1.6056	89.8831	.8710	55.981292	.358	1.279	.004	.002
435.	1.5589	85.4546	.8868	54.818759	.324	1.347	.005	.002
440.	1.5181	81.6200	.9003	53.764937	.291	1.412	.006	.003
445.	1.4821	78.2686	.9118	52.811022	.261	1.471	.007	.003
450.	1.4498	75.3406	.9217	51.964690	.233	1.526	.008	.004
455.	1.4208	72.7539	.9303	51.206706	.207	1.577	.009	.004
460.	1.3944	70.4636	.9376	50.534515	.184	1.622	.010	.005
465.	1.3702	68.4234	.9439	49.938065	.163	1.663	.011	.006
470.	1.3479	66.6005	.9493	49.412147	.144	1.699	.013	.006
475.	1.3272	64.9619	.9539	48.947767	.127	1.732	.014	.007
480.	1.3079	63.4821	.9579	48.538212	.112	1.760	.016	.008
485.	1.2898	62.1388	.9613	48.177181	.099	1.785	.018	.009
490.	1.2728	60.9125	.9643	47.858227	.087	1.806	.020	.010
495.	1.2567	59.7867	.9668	47.575928	.077	1.825	.022	.011
500.	1.2413	58.7472	.9689	47.325300	.068	1.840	.024	.012
505.	1.2267	57.7817	.9707	47.101901	.060	1.854	.027	.013
510.	1.2127	56.8796	.9723	46.901817	.053	1.865	.029	.015
515.	1.1993	56.0320	.9737	46.721611	.047	1.875	.032	.016
520.	1.1863	55.2309	.9749	46.558232	.041	1.882	.035	.018
525.	1.1737	54.4695	.9760	46.409025	.037	1.888	.039	.019
530.	1.1614	53.7422	.9769	46.271748	.032	1.893	.042	.021
535.	1.1495	53.0437	.9779	46.144339	.029	1.897	.046	.023
540.	1.1379	52.3699	.9787	46.025100	.026	1.899	.050	.025
545.	1.1264	51.7168	.9796	45.912502	.023	1.901	.054	.027
550.	1.1152	51.0814	.9805	45.805242	.020	1.901	.058	.029

6.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.7524	1448.6882	.1553	91.966342	.999	.001	.000	.000
300.	15.6360	1437.7653	.1538	91.952505	.999	.001	.000	.000
305.	15.5187	1426.6810	.1525	91.933294	.999	.002	.000	.000
310.	15.3995	1415.4127	.1512	91.912692	.999	.002	.000	.000
315.	15.2779	1403.8375	.1500	91.886555	.999	.003	.000	.000
320.	15.1534	1391.9062	.1488	91.854246	.998	.004	.000	.000
325.	15.0257	1379.5791	.1478	91.814874	.998	.004	.000	.000
330.	14.8944	1366.8132	.1468	91.766758	.997	.005	.000	.000
335.	14.7596	1353.5990	.1460	91.709881	.997	.007	.000	.000
340.	14.6209	1339.8813	.1452	91.641441	.996	.008	.000	.000
345.	14.4782	1325.6211	.1445	91.559705	.995	.010	.000	.000
350.	14.3313	1310.7752	.1439	91.462538	.994	.012	.000	.000
355.	14.1797	1295.2731	.1434	91.347302	.993	.014	.000	.000
360.	14.0228	1279.0407	.1430	91.211362	.991	.017	.000	.000
365.	13.8600	1261.9716	.1426	91.051081	.989	.021	.000	.000
370.	13.6903	1243.9330	.1425	90.862461	.987	.025	.000	.000
375.	13.5122	1224.7541	.1424	90.640874	.985	.030	.000	.000
380.	13.3237	1204.2096	.1425	90.380783	.982	.036	.000	.000
385.	13.1223	1182.0013	.1428	90.075826	.979	.042	.000	.000
390.	12.9039	1157.7102	.1434	89.717944	.975	.050	.001	.000
395.	12.6625	1130.7340	.1443	89.297637	.970	.060	.001	.000
400.	12.3885	1100.1390	.1456	88.803223	.964	.071	.001	.000
405.	12.0644	1064.3212	.1477	88.219772	.958	.084	.001	.001
410.	11.6541	1020.0616	.1510	87.528243	.949	.100	.001	.001
411.20	11.5348	1007.4897	.1508	87.343706	.947	.104	.002	.001
411.20	2.6096	164.8737	.6664	63.180859	.545	.909	.002	.001
415.	2.4111	149.3189	.7212	61.928589	.515	.967	.002	.001
420.	2.2411	135.2683	.7667	60.356731	.477	1.044	.003	.001
425.	2.1199	124.8188	.8010	58.878748	.439	1.119	.003	.002
430.	2.0262	116.5119	.8283	57.503469	.402	1.193	.004	.002
435.	1.9502	109.6538	.8507	56.228153	.366	1.264	.004	.002
440.	1.8866	103.8943	.8694	55.070161	.332	1.332	.005	.003
445.	1.8322	98.9619	.8851	54.012781	.299	1.395	.006	.003
450.	1.7849	94.6958	.8985	53.054839	.269	1.455	.007	.003
455.	1.7431	90.9395	.9099	52.170750	.241	1.510	.009	.004
460.	1.7059	87.7321	.9197	51.429964	.215	1.560	.009	.004
465.	1.6723	84.8594	.9280	50.744417	.192	1.606	.010	.005
470.	1.6418	82.3142	.9352	50.136742	.170	1.648	.011	.006
475.	1.6139	80.0439	.9414	49.597234	.151	1.685	.013	.006
480.	1.5881	78.0092	.9467	49.119558	.134	1.718	.015	.007
485.	1.5643	76.1759	.9512	48.696894	.119	1.747	.016	.008
490.	1.5420	74.5150	.9551	48.322828	.105	1.772	.018	.009
495.	1.5211	73.0019	.9584	47.991436	.093	1.794	.020	.010
500.	1.5015	71.6154	.9613	47.697317	.082	1.814	.022	.011
505.	1.4828	70.3373	.9637	47.435572	.073	1.830	.025	.012
510.	1.4650	69.1521	.9658	47.201831	.064	1.845	.027	.014
515.	1.4480	68.0465	.9677	46.992182	.057	1.857	.030	.015
520.	1.4317	67.0088	.9693	46.803167	.050	1.867	.033	.016
525.	1.4160	66.0293	.9708	46.631774	.045	1.875	.036	.018
530.	1.4007	65.0992	.9721	46.475306	.040	1.882	.039	.020
535.	1.3859	64.2112	.9733	46.331435	.035	1.887	.043	.021
540.	1.3715	63.3588	.9744	46.198115	.031	1.891	.046	.023
545.	1.3573	62.5367	.9755	46.073597	.028	1.894	.050	.025
550.	1.3434	61.7399	.9767	45.956302	.025	1.896	.054	.027

8.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.7799	1451.2404	.2067	91.967828	.999	.001	.000	.000
300.	15.6647	1440.4354	.2047	91.954443	.999	.001	.000	.000
305.	15.5487	1429.5103	.2029	91.937512	.999	.002	.000	.000
310.	15.4311	1418.3583	.2011	91.915695	.999	.002	.000	.000
315.	15.3111	1406.9422	.1995	91.890399	.999	.003	.000	.000
320.	15.1883	1395.1834	.1980	91.859082	.998	.003	.000	.000
325.	15.0624	1383.0440	.1966	91.820913	.998	.004	.000	.000
330.	14.9332	1370.4805	.1953	91.774087	.997	.005	.000	.000
335.	14.8005	1357.4921	.1941	91.719061	.997	.006	.000	.000
340.	14.6643	1344.0236	.1930	91.652822	.996	.008	.000	.000
345.	14.5243	1330.0428	.1920	91.573730	.995	.010	.000	.000
350.	14.3803	1315.5069	.1912	91.479749	.994	.012	.000	.000
355.	14.2321	1300.3587	.1904	91.368309	.993	.014	.000	.000
360.	14.0791	1284.5350	.1898	91.237115	.992	.017	.000	.000
365.	13.9208	1267.9408	.1894	91.082553	.990	.020	.000	.000
370.	13.7563	1250.4627	.1890	90.900908	.988	.024	.000	.000
375.	13.5846	1231.9554	.1889	90.687850	.985	.029	.000	.000
380.	13.4040	1212.2302	.1889	90.438212	.983	.034	.000	.000
385.	13.2124	1191.0429	.1892	90.146119	.979	.041	.000	.000
390.	13.0067	1168.0602	.1897	89.804164	.976	.048	.000	.000
395.	12.7827	1142.8225	.1906	89.403698	.971	.057	.001	.000
400.	12.5335	1114.6581	.1919	88.934194	.966	.068	.001	.000
405.	12.2480	1082.5074	.1940	88.382319	.959	.081	.001	.000
410.	11.9059	1044.5231	.1971	87.731502	.952	.096	.001	.001
415.	11.4637	996.8775	.2023	86.959715	.943	.114	.001	.001
420.	10.7954	928.8116	.2122	86.037682	.931	.136	.002	.001
422.07	10.3501	885.9835	.2187	85.601670	.926	.146	.002	.001
422.07	4.0268	253.5204	.5622	62.958868	.540	.919	.002	.001
425.	3.5285	218.7419	.6416	61.992340	.517	.964	.003	.001
430.	3.1420	189.8374	.7122	60.419483	.479	1.040	.003	.002
435.	2.9138	171.7709	.7591	58.950240	.441	1.115	.004	.002
440.	2.7526	158.5162	.7945	57.588131	.404	1.187	.004	.002
445.	2.6289	148.0960	.8225	56.333658	.369	1.257	.005	.002
450.	2.5294	139.5867	.8454	55.186570	.336	1.323	.006	.003
455.	2.4466	132.4670	.8643	54.143086	.304	1.386	.007	.003
460.	2.3762	126.4092	.8803	53.198236	.274	1.444	.008	.004
465.	2.3152	121.1928	.8938	52.346963	.247	1.498	.009	.004
470.	2.2616	116.6656	.9052	51.586403	.221	1.548	.010	.005
475.	2.2139	112.6939	.9150	50.904031	.198	1.593	.011	.006
480.	2.1710	109.1889	.9234	50.294956	.177	1.634	.013	.006
485.	2.1321	106.0765	.9305	49.752639	.158	1.671	.014	.007
490.	2.0965	103.2952	.9366	49.270013	.140	1.704	.016	.008
495.	2.0637	100.7950	.9419	48.840795	.125	1.733	.018	.009
500.	2.0333	98.5340	.9464	48.459022	.111	1.759	.020	.010
505.	2.0050	96.4769	.9503	48.119109	.099	1.781	.022	.011
510.	1.9783	94.5938	.9537	47.815978	.088	1.801	.024	.012
515.	1.9531	92.8593	.9566	47.545000	.078	1.818	.026	.013
520.	1.9291	91.2516	.9592	47.302018	.069	1.833	.029	.014
525.	1.9062	89.7519	.9614	47.083300	.061	1.845	.032	.016
530.	1.8843	88.3442	.9635	46.885505	.055	1.856	.035	.017
535.	1.8630	87.0145	.9654	46.705681	.049	1.865	.038	.019
540.	1.8425	85.7510	.9671	46.541242	.043	1.872	.041	.021
545.	1.8225	84.5433	.9687	46.389871	.039	1.878	.045	.022
550.	1.8029	83.3826	.9704	46.249564	.035	1.882	.048	.024

10.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.8073	1453.7879	.2579	91.969225	.999	.001	.000	.000
300.	15.6933	1443.0952	.2555	91.956272	.999	.001	.000	.000
305.	15.5786	1432.2961	.2531	91.939842	.999	.002	.000	.000
310.	15.4624	1421.2812	.2509	91.918518	.999	.002	.000	.000
315.	15.3440	1410.0175	.2488	91.894014	.999	.003	.000	.000
320.	15.2228	1398.4235	.2469	91.863620	.998	.003	.000	.000
325.	15.0987	1386.4628	.2451	91.826557	.998	.004	.000	.000
330.	14.9714	1374.1043	.2434	91.781761	.997	.005	.000	.000
335.	14.8409	1361.3171	.2419	91.727586	.997	.006	.000	.000
340.	14.7069	1348.0836	.2405	91.663351	.996	.008	.000	.000
345.	14.5694	1334.3635	.2393	91.586673	.995	.009	.000	.000
350.	14.4282	1320.1194	.2382	91.495597	.994	.011	.000	.000
355.	14.2831	1305.2987	.2372	91.387516	.993	.014	.000	.000
360.	14.1337	1289.8524	.2364	91.260613	.992	.016	.000	.000
365.	13.9795	1273.6927	.2357	91.111143	.990	.020	.000	.000
370.	13.8199	1256.7232	.2352	90.935720	.988	.024	.000	.000
375.	13.6539	1238.8179	.2349	90.730168	.986	.028	.000	.000
380.	13.4802	1219.8171	.2348	90.489654	.983	.033	.000	.000
385.	13.2971	1199.5179	.2349	90.208701	.980	.040	.000	.000
390.	13.1024	1177.6507	.2354	89.880545	.976	.047	.000	.000
395.	12.8926	1153.8526	.2362	89.497082	.972	.055	.000	.000
400.	12.6630	1127.6195	.2375	89.048665	.967	.066	.001	.000
405.	12.4058	1098.2095	.2394	88.523545	.961	.078	.001	.000
410.	12.1088	1064.4401	.2423	87.906668	.954	.092	.001	.000
415.	11.7485	1024.2245	.2467	87.179235	.945	.109	.001	.001
420.	11.2746	973.1791	.2540	86.316083	.935	.129	.001	.001
425.	10.5413	898.9936	.2685	85.282728	.922	.155	.002	.001
430.	8.7092	731.8331	.3212	84.029884	.906	.186	.002	.001
430.76	7.5646	634.0359	.3655	83.816580	.903	.191	.002	.001
430.76	7.5630	479.2393	.3656	63.366234	.549	.899	.003	.001
435.	4.4711	276.4715	.6184	61.835070	.513	.970	.003	.002
440.	3.9411	237.2536	.6936	60.200238	.473	1.050	.004	.002
445.	3.6338	213.3398	.7438	58.710039	.435	1.126	.004	.002
450.	3.4199	196.1479	.7815	57.354089	.398	1.199	.005	.003
455.	3.2580	182.8289	.8114	56.117553	.363	1.268	.006	.003
460.	3.1289	172.0742	.8356	54.994837	.330	1.333	.007	.003
465.	3.0226	163.1544	.8557	53.978963	.299	1.394	.008	.004
470.	2.9327	155.6165	.8726	53.062537	.270	1.451	.009	.004
475.	2.8553	149.1495	.8868	52.235510	.243	1.503	.010	.005
480.	2.7877	143.5653	.8989	51.500127	.219	1.551	.011	.006
485.	2.7277	138.6751	.9091	50.838748	.196	1.595	.013	.006
490.	2.6741	134.3665	.9179	50.247820	.176	1.634	.014	.007
495.	2.6255	130.5426	.9254	49.720236	.157	1.670	.016	.008
500.	2.5813	127.1258	.9319	49.249535	.140	1.702	.018	.009
505.	2.5405	124.0530	.9375	48.829627	.125	1.730	.019	.010
510.	2.5028	121.2715	.9423	48.454785	.112	1.755	.022	.011
515.	2.4675	118.7373	.9465	48.119802	.100	1.777	.024	.012
520.	2.4344	116.4136	.9501	47.819888	.089	1.796	.026	.013
525.	2.4031	114.2687	.9533	47.550730	.079	1.813	.029	.014
530.	2.3733	112.2759	.9562	47.308417	.071	1.827	.031	.016
535.	2.3447	110.4121	.9588	47.089438	.063	1.840	.034	.017
540.	2.3173	108.6575	.9612	46.890664	.056	1.850	.037	.019
545.	2.2907	106.9952	.9634	46.709323	.050	1.859	.040	.020
550.	2.2648	105.4105	.9656	46.542939	.045	1.866	.044	.022

12.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.8348	1456.3328	.3090	91.970541	1.000	.001	.000	.000
300.	15.7218	1445.7465	.3060	91.958001	.999	.001	.000	.000
305.	15.6084	1435.0678	.3032	91.942049	.999	.002	.000	.000
310.	15.4935	1424.1838	.3005	91.921182	.999	.002	.000	.000
315.	15.3766	1413.0660	.2980	91.897434	.999	.003	.000	.000
320.	15.2570	1401.6297	.2956	91.867912	.998	.003	.000	.000
325.	15.1346	1389.8396	.2934	91.831884	.998	.004	.000	.000
330.	15.0092	1377.6665	.2914	91.788343	.998	.005	.000	.000
335.	14.8806	1365.0802	.2895	91.735605	.997	.006	.000	.000
340.	14.7488	1352.0690	.2878	91.673226	.996	.007	.000	.000
345.	14.6137	1338.5946	.2863	91.598778	.995	.009	.000	.000
350.	14.4751	1324.6243	.2849	91.510392	.994	.011	.000	.000
355.	14.3330	1310.1159	.2837	91.405853	.993	.013	.000	.000
360.	14.1869	1295.0129	.2826	91.282417	.992	.016	.000	.000
365.	14.0365	1279.2545	.2817	91.137667	.990	.019	.000	.000
370.	13.8813	1262.7497	.2810	90.967891	.989	.023	.000	.000
375.	13.7204	1245.3896	.2805	90.769151	.986	.027	.000	.000
380.	13.5529	1227.0384	.2802	90.536951	.984	.032	.000	.000
385.	13.3774	1207.5224	.2802	90.265953	.981	.038	.000	.000
390.	13.1920	1186.6215	.2805	89.950054	.977	.045	.000	.000
395.	12.9942	1164.0426	.2812	89.581658	.973	.054	.000	.000
400.	12.7804	1139.3949	.2823	89.151902	.968	.063	.000	.000
405.	12.5452	1112.1313	.2841	88.650041	.962	.075	.001	.000
410.	12.2804	1081.4405	.2867	88.062637	.955	.088	.001	.000
415.	11.9720	1046.0323	.2905	87.372978	.947	.105	.001	.000
420.	11.5945	1003.6137	.2964	86.559246	.938	.124	.001	.001
425.	11.0924	949.4295	.3062	85.592833	.926	.147	.001	.001
430.	10.3163	871.0430	.3254	84.433574	.911	.176	.002	.001
435.	8.7661	727.7834	.3785	83.022166	.893	.212	.002	.001
440.	6.0390	490.7429	.5432	81.262912	.869	.259	.003	.001
445.	5.0327	310.3122	.6445	61.659252	.510	.977	.004	.002
450.	4.5415	271.7313	.7062	59.832521	.464	1.067	.004	.002
455.	4.2227	246.1271	.7512	58.286546	.424	1.147	.005	.003
460.	3.9908	227.1682	.7862	56.923258	.387	1.221	.006	.003
465.	3.8111	212.2967	.8144	55.705360	.352	1.290	.007	.003
470.	3.6660	200.2137	.8377	54.613731	.319	1.354	.008	.004
475.	3.5454	190.1575	.8570	53.634406	.289	1.413	.009	.004
480.	3.4430	181.6407	.8733	52.756179	.261	1.468	.010	.005
485.	3.3545	174.3313	.8871	51.969640	.235	1.518	.011	.006
490.	3.2768	167.9895	.8989	51.265943	.212	1.564	.013	.006
495.	3.2079	162.4343	.9089	50.636318	.190	1.606	.014	.007
500.	3.1460	157.5300	.9176	50.073816	.170	1.643	.016	.008
505.	3.0898	153.1667	.9250	49.571090	.153	1.677	.018	.009
510.	3.0385	149.2573	.9314	49.121796	.137	1.707	.020	.010
515.	2.9912	145.7307	.9369	48.720130	.122	1.734	.022	.011
520.	2.9472	142.5275	.9418	48.360576	.109	1.758	.024	.012
525.	2.9060	139.5982	.9460	48.038235	.098	1.778	.026	.013
530.	2.8671	136.9014	.9498	47.748670	.087	1.797	.029	.014
535.	2.8302	134.4014	.9532	47.487829	.078	1.813	.031	.016
540.	2.7950	132.0682	.9563	47.252075	.070	1.826	.034	.017
545.	2.7611	129.8758	.9591	47.038161	.062	1.838	.037	.019
550.	2.7283	127.8020	.9618	46.843199	.056	1.848	.040	.020

14.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		moss	N2O4	NO2	NO	O2
295.	15.8622	1458.8769	.3598	91.971782	1.000	.001	.000	.000
300.	15.7503	1448.3914	.3564	91.959639	.999	.001	.000	.000
305.	15.6381	1437.8274	.3530	91.944143	.999	.002	.000	.000
310.	15.5245	1427.0864	.3499	91.924851	.999	.002	.000	.000
315.	15.4089	1416.0902	.3469	91.900675	.999	.003	.000	.000
320.	15.2909	1404.8047	.3441	91.871984	.998	.003	.000	.000
325.	15.1701	1393.1776	.3415	91.836937	.998	.004	.000	.000
330.	15.0464	1381.1817	.3391	91.794574	.998	.005	.000	.000
335.	14.9198	1368.7859	.3369	91.743183	.997	.006	.000	.000
340.	14.7900	1355.9857	.3349	91.682555	.996	.007	.000	.000
345.	14.6571	1342.7434	.3330	91.610188	.996	.009	.000	.000
350.	14.5211	1329.0308	.3313	91.524310	.995	.011	.000	.000
355.	14.3817	1314.8109	.3298	91.422787	.994	.013	.000	.000
360.	14.2387	1300.0318	.3285	91.302840	.992	.016	.000	.000
365.	14.0918	1284.6450	.3274	91.162465	.991	.019	.000	.000
370.	13.9406	1268.5677	.3264	90.997920	.989	.022	.000	.000
375.	13.7845	1251.7050	.3257	90.805462	.987	.026	.000	.000
380.	13.6225	1233.9395	.3253	90.580825	.984	.031	.000	.000
385.	13.4537	1215.1222	.3251	90.318929	.981	.037	.000	.000
390.	13.2765	1195.0696	.3252	90.014114	.978	.044	.000	.000
395.	13.0889	1173.5419	.3257	89.659388	.974	.052	.000	.000
400.	12.8882	1150.2256	.3266	89.246361	.969	.061	.000	.000
405.	12.6705	1124.7017	.3281	88.765149	.964	.072	.000	.000
410.	12.4301	1096.3851	.3304	88.203799	.957	.085	.001	.000
415.	12.1581	1064.4050	.3337	87.547021	.949	.101	.001	.000
420.	11.8395	1027.3868	.3386	86.776031	.940	.119	.001	.000
425.	11.4471	982.9130	.3461	85.865766	.929	.141	.001	.001
430.	10.9241	926.1837	.3585	84.783430	.915	.168	.001	.001
435.	10.1394	846.4581	.3818	83.481990	.899	.201	.002	.001
440.	8.8554	725.1807	.4322	81.891362	.878	.243	.002	.001
445.	7.1781	573.4864	.5271	79.893526	.850	.298	.003	.001
450.	6.0290	465.7315	.6206	77.247918	.811	.375	.004	.002
455.	5.3961	331.0845	.6858	61.356308	.503	.990	.005	.002
460.	4.9877	295.5764	.7339	59.260484	.450	1.094	.006	.003
465.	4.6940	270.7336	.7714	57.676268	.408	1.178	.006	.003
470.	4.4686	251.6951	.8017	56.325288	.370	1.253	.007	.004
475.	4.2881	236.4597	.8267	55.143337	.335	1.321	.008	.004
480.	4.1391	223.9148	.8475	54.097268	.304	1.383	.009	.005
485.	4.0133	213.3771	.8651	53.167319	.275	1.440	.011	.005
490.	3.9051	204.3793	.8800	52.336115	.248	1.493	.012	.006
495.	3.8107	196.6228	.8927	51.597735	.223	1.540	.013	.007
500.	3.7272	189.8522	.9035	50.937379	.201	1.583	.015	.007
505.	3.6525	183.8915	.9129	50.347084	.181	1.622	.016	.008
510.	3.5850	178.6022	.9210	49.819482	.162	1.658	.018	.009
515.	3.5234	173.8739	.9280	49.347845	.145	1.689	.020	.010
520.	3.4668	169.6159	.9340	48.925703	.130	1.717	.022	.011
525.	3.4143	165.7542	.9394	48.547445	.117	1.742	.024	.012
530.	3.3652	162.2278	.9441	48.208087	.105	1.764	.027	.013
535.	3.3189	158.9845	.9483	47.902914	.094	1.783	.029	.015
540.	3.2750	155.9808	.9521	47.627815	.084	1.800	.032	.016
545.	3.2331	153.1795	.9556	47.379078	.075	1.815	.035	.017
550.	3.1928	150.5489	.9589	47.153353	.067	1.828	.038	.019

16.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.8897	1461.4225	.4105	91.972953	1.000	.001	.000	.000
300.	15.7787	1451.0318	.4065	91.961191	.999	.001	.000	.000
305.	15.6676	1440.5769	.4027	91.946134	.999	.002	.000	.000
310.	15.5553	1429.9570	.3991	91.927359	.999	.002	.000	.000
315.	15.4411	1419.0923	.3956	91.903751	.999	.002	.000	.000
320.	15.3245	1407.9512	.3924	91.875856	.998	.003	.000	.000
325.	15.2053	1396.4797	.3894	91.841741	.998	.004	.000	.000
330.	15.0833	1384.6525	.3866	91.800495	.998	.005	.000	.000
335.	14.9584	1372.4473	.3840	91.750953	.997	.006	.000	.000
340.	14.8306	1359.8390	.3816	91.691405	.996	.007	.000	.000
345.	14.6999	1346.8163	.3795	91.620995	.996	.009	.000	.000
350.	14.5661	1333.3467	.3775	91.537468	.995	.010	.000	.000
355.	14.4293	1319.3978	.3757	91.438771	.994	.013	.000	.000
360.	14.2892	1304.9215	.3741	91.322089	.992	.015	.000	.000
365.	14.1456	1289.8802	.3727	91.185788	.991	.018	.000	.000
370.	13.9982	1274.1974	.3716	91.026083	.989	.022	.000	.000
375.	13.8463	1257.7915	.3706	90.839504	.987	.026	.000	.000
380.	13.6894	1240.5584	.3699	90.621874	.985	.031	.000	.000
385.	13.5265	1222.3688	.3695	90.368317	.982	.036	.000	.000
390.	13.3565	1203.0704	.3694	90.073770	.979	.043	.000	.000
395.	13.1778	1182.4601	.3697	89.731461	.975	.050	.000	.000
400.	12.9882	1160.2826	.3704	89.333617	.970	.059	.000	.000
405.	12.7849	1136.2074	.3717	88.871113	.965	.070	.000	.000
410.	12.5637	1109.7916	.3736	88.332955	.959	.082	.001	.000
415.	12.3187	1080.4143	.3764	87.705431	.951	.097	.001	.000
420.	12.0403	1047.1679	.3805	86.971708	.942	.114	.001	.000
425.	11.7132	1008.6261	.3866	86.110013	.932	.135	.001	.001
430.	11.3098	962.3747	.3957	85.092360	.919	.160	.001	.001
435.	10.7770	903.9756	.4105	83.880226	.904	.191	.002	.001
440.	10.0178	825.6618	.4366	82.419758	.885	.229	.002	.001
445.	8.9550	722.0164	.4829	80.627487	.860	.278	.002	.001
450.	7.7690	608.7948	.5504	78.361621	.827	.342	.003	.002
455.	6.7984	512.0312	.6221	75.316723	.780	.436	.004	.002
460.	6.1360	430.4797	.6818	70.156077	.691	.614	.005	.002
465.	5.6787	342.9139	.7288	60.385982	.479	1.036	.006	.003
470.	5.3429	311.9654	.7663	58.389003	.427	1.139	.007	.003
475.	5.0833	289.0358	.7970	56.860258	.386	1.221	.008	.004
480.	4.8748	270.9202	.8224	55.575542	.349	1.294	.009	.004
485.	4.7026	256.1119	.8437	54.461597	.315	1.360	.010	.005
490.	4.5572	243.7314	.8618	53.482640	.285	1.419	.011	.005
495.	4.4322	233.2050	.8771	52.615896	.257	1.473	.012	.006
500.	4.3232	224.1423	.8903	51.846786	.232	1.522	.014	.007
505.	4.2268	216.2487	.9015	51.161295	.209	1.566	.015	.008
510.	4.1407	209.3114	.9113	50.550092	.188	1.607	.017	.008
515.	4.0629	203.1615	.9197	50.004101	.169	1.643	.019	.009
520.	3.9920	197.6672	.9270	49.515913	.152	1.675	.021	.010
525.	3.9268	192.7215	.9335	49.078823	.137	1.704	.023	.011
530.	3.8663	188.2377	.9391	48.687079	.123	1.730	.025	.012
535.	3.8097	184.1430	.9442	48.335244	.110	1.753	.027	.014
540.	3.7564	180.3768	.9487	48.018643	.099	1.773	.030	.015
545.	3.7058	176.8881	.9528	47.733032	.089	1.791	.032	.016
550.	3.6574	173.6334	.9567	47.474650	.079	1.806	.035	.018

18.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.9172	1463.9717	.4611	91.974060	1.000	.001	.000	.000
300.	15.8072	1453.6699	.4565	91.962665	.999	.001	.000	.000
305.	15.6971	1443.3183	.4522	91.948028	.999	.001	.000	.000
310.	15.5860	1432.8138	.4481	91.929748	.999	.002	.000	.000
315.	15.4730	1422.0747	.4442	91.906675	.999	.002	.000	.000
320.	15.3578	1411.0716	.4405	91.879542	.999	.003	.000	.000
325.	15.2401	1399.7491	.4371	91.846317	.998	.004	.000	.000
330.	15.1197	1388.0826	.4339	91.806133	.998	.005	.000	.000
335.	14.9965	1376.0511	.4309	91.757868	.997	.006	.000	.000
340.	14.8706	1363.6332	.4282	91.699823	.997	.007	.000	.000
345.	14.7419	1350.8188	.4257	91.631264	.996	.008	.000	.000
350.	14.6104	1337.5789	.4234	91.549952	.995	.010	.000	.000
355.	14.4760	1323.8850	.4213	91.453914	.994	.012	.000	.000
360.	14.3386	1309.6926	.4194	91.340307	.993	.015	.000	.000
365.	14.1981	1294.9734	.4178	91.207822	.991	.018	.000	.000
370.	14.0540	1279.6571	.4163	91.052684	.989	.021	.000	.000
375.	13.9061	1263.6715	.4152	90.871560	.987	.025	.000	.000
380.	13.7538	1246.9252	.4142	90.660463	.985	.030	.000	.000
385.	13.5963	1229.3035	.4136	90.414601	.982	.035	.000	.000
390.	13.4327	1210.6808	.4133	90.129557	.979	.042	.000	.000
395.	13.2617	1190.8810	.4133	89.798692	.975	.049	.000	.000
400.	13.0816	1169.6921	.4137	89.414754	.971	.058	.000	.000
405.	12.8904	1146.8469	.4147	88.969265	.966	.068	.000	.000
410.	12.6848	1121.9979	.4163	88.452028	.960	.080	.000	.000
415.	12.4607	1094.6825	.4187	87.850717	.953	.094	.001	.000
420.	12.2118	1064.2571	.4221	87.149907	.945	.110	.001	.000
425.	11.9285	1029.7965	.4270	86.330739	.935	.130	.001	.000
430.	11.5954	989.8819	.4342	85.368563	.923	.153	.001	.001
435.	11.1863	942.2339	.4449	84.231246	.908	.182	.001	.001
440.	10.6566	883.1648	.4617	82.875291	.891	.217	.002	.001
445.	9.9467	808.0545	.4891	81.238095	.868	.261	.002	.001
450.	9.0594	717.7202	.5310	79.224206	.840	.318	.003	.001
455.	8.1421	624.2429	.5844	76.668589	.801	.394	.003	.002
460.	7.3509	538.2102	.6402	73.217337	.745	.505	.004	.002
465.	6.7386	455.3596	.6909	67.574921	.641	.713	.005	.003
470.	6.2778	385.4624	.7337	61.400666	.504	.985	.006	.003
475.	5.9245	349.3738	.7693	58.971139	.443	1.107	.007	.004
480.	5.6453	323.3083	.7989	57.270676	.397	1.197	.008	.004
485.	5.4183	302.8469	.8238	55.892988	.358	1.274	.009	.005
490.	5.2295	286.1657	.8449	54.721365	.324	1.343	.010	.005
495.	5.0693	272.2374	.8628	53.703228	.292	1.404	.012	.006
500.	4.9311	260.4059	.8781	52.808673	.264	1.459	.013	.006
505.	4.8103	250.2185	.8912	52.017489	.238	1.509	.014	.007
510.	4.7033	241.3488	.9026	51.314990	.215	1.554	.016	.008
515.	4.6075	233.5506	.9124	50.689298	.194	1.595	.018	.009
520.	4.5209	226.6362	.9209	50.131139	.174	1.632	.019	.010
525.	4.4418	220.4548	.9284	49.632052	.157	1.665	.021	.011
530.	4.3689	214.8872	.9350	49.185247	.141	1.695	.023	.012
535.	4.3013	209.8347	.9408	48.784472	.127	1.721	.026	.013
540.	4.2379	205.2165	.9460	48.424357	.114	1.744	.028	.014
545.	4.1780	200.9643	.9508	48.100061	.102	1.765	.031	.015
550.	4.1211	197.0208	.9551	47.807286	.092	1.783	.033	.017

20.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	15.9448	1466.5269	.5114	91.975106	1.000	.001	.000	.000
300.	15.8356	1456.3078	.5063	91.964065	.999	.001	.000	.000
305.	15.7266	1446.0538	.5015	91.949832	.999	.001	.000	.000
310.	15.6165	1435.6591	.4969	91.932026	.999	.002	.000	.000
315.	15.5048	1425.0495	.4925	91.910100	.999	.002	.000	.000
320.	15.3910	1414.1683	.4884	91.883056	.999	.003	.000	.000
325.	15.2747	1402.9881	.4846	91.850683	.998	.004	.000	.000
330.	15.1558	1391.4753	.4810	91.811510	.998	.004	.000	.000
335.	15.0343	1379.6104	.4776	91.764461	.997	.005	.000	.000
340.	14.9101	1367.3725	.4745	91.707845	.997	.007	.000	.000
345.	14.7833	1354.7560	.4716	91.641044	.996	.008	.000	.000
350.	14.6539	1341.7333	.4690	91.561828	.995	.010	.000	.000
355.	14.5218	1328.2801	.4666	91.468301	.994	.012	.000	.000
360.	14.3869	1314.3638	.4644	91.358254	.993	.014	.000	.000
365.	14.2492	1299.9365	.4625	91.228707	.991	.017	.000	.000
370.	14.1084	1284.9612	.4608	91.077856	.990	.020	.000	.000
375.	13.9641	1269.3644	.4594	90.901849	.988	.024	.000	.000
380.	13.8160	1253.0654	.4582	90.696869	.986	.029	.000	.000
385.	13.6633	1235.9606	.4573	90.458155	.983	.034	.000	.000
390.	13.5054	1217.9475	.4567	90.181944	.980	.040	.000	.000
395.	13.3413	1198.8697	.4565	89.861618	.976	.048	.000	.000
400.	13.1696	1178.5506	.4566	89.490569	.972	.056	.000	.000
405.	12.9885	1156.7667	.4573	89.060675	.967	.066	.000	.000
410.	12.7959	1133.2367	.4585	88.562354	.961	.077	.000	.000
415.	12.5886	1107.6082	.4604	87.984833	.954	.091	.001	.000
420.	12.3623	1079.3968	.4633	87.313636	.946	.106	.001	.000
425.	12.1106	1047.9560	.4674	86.531938	.937	.125	.001	.000
430.	11.8242	1012.3621	.4731	85.617917	.926	.147	.001	.001
435.	11.4883	971.2735	.4813	84.544615	.912	.174	.001	.001
440.	11.0798	922.6733	.4934	83.274924	.896	.207	.002	.001
445.	10.5654	863.8351	.5116	81.760916	.876	.247	.002	.001
450.	9.9166	792.6460	.5390	79.931313	.850	.298	.002	.001
455.	9.1666	712.0681	.5767	77.680961	.817	.363	.003	.001
460.	8.4207	630.1743	.6210	74.836413	.772	.452	.004	.002
465.	7.7628	551.7646	.6664	71.078154	.708	.580	.005	.002
470.	7.2203	476.7361	.7088	66.027440	.609	.776	.005	.003
475.	6.7849	419.0942	.7464	61.769096	.514	.966	.006	.003
480.	6.4353	381.5050	.7787	59.283369	.452	1.089	.007	.004
485.	6.1508	353.6874	.8064	57.502667	.404	1.183	.008	.004
490.	5.9152	331.6852	.8299	56.073201	.364	1.263	.010	.005
495.	5.7167	313.6648	.8501	54.867839	.328	1.332	.011	.005
500.	5.5469	298.5734	.8673	53.827479	.297	1.395	.012	.006
505.	5.3994	285.7226	.8822	52.917353	.268	1.451	.014	.007
510.	5.2698	274.6294	.8950	52.113667	.242	1.501	.015	.008
515.	5.1546	264.9634	.9061	51.403258	.218	1.547	.017	.008
520.	5.0511	256.4467	.9158	50.770418	.197	1.588	.018	.009
525.	4.9572	248.8819	.9243	50.206012	.177	1.625	.020	.010
530.	4.8712	242.1084	.9317	49.701495	.160	1.658	.022	.011
535.	4.7918	235.9969	.9383	49.249653	.144	1.688	.024	.012
540.	4.7179	230.4412	.9442	48.844145	.129	1.715	.027	.013
545.	4.6484	225.3537	.9495	48.479498	.116	1.738	.029	.014
550.	4.5827	220.6607	.9544	48.150840	.105	1.759	.032	.016

25.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	16.0143	1472.9584	.6365	91.977484	1.000	.001	.000	.000
300.	15.9069	1462.9172	.6301	91.967272	.999	.001	.000	.000
305.	15.8001	1452.8812	.6240	91.953988	.999	.001	.000	.000
310.	15.6926	1442.7358	.6181	91.937285	.999	.002	.000	.000
315.	15.5837	1432.4027	.6125	91.916678	.999	.002	.000	.000
320.	15.4729	1421.8224	.6073	91.891162	.999	.003	.000	.000
325.	15.3599	1410.9702	.6023	91.860767	.998	.003	.000	.000
330.	15.2445	1399.8114	.5977	91.823935	.998	.004	.000	.000
335.	15.1268	1388.3300	.5934	91.779685	.997	.005	.000	.000
340.	15.0067	1376.5129	.5893	91.726831	.997	.006	.000	.000
345.	14.8842	1364.3420	.5856	91.663600	.996	.008	.000	.000
350.	14.7595	1351.8146	.5821	91.589182	.995	.009	.000	.000
355.	14.6326	1338.9069	.5788	91.501380	.994	.011	.000	.000
360.	14.5035	1325.5954	.5759	91.398167	.993	.013	.000	.000
365.	14.3721	1311.8400	.5732	91.276581	.992	.016	.000	.000
370.	14.2384	1297.6221	.5708	91.135410	.990	.019	.000	.000
375.	14.1021	1282.8813	.5686	90.970894	.989	.023	.000	.000
380.	13.9630	1267.5585	.5667	90.779695	.986	.027	.000	.000
385.	13.8208	1251.5795	.5651	90.557837	.984	.032	.000	.000
390.	13.6749	1234.8495	.5638	90.300340	.981	.038	.000	.000
395.	13.5248	1217.2839	.5628	90.003520	.978	.044	.000	.000
400.	13.3698	1198.7465	.5622	89.660644	.974	.052	.000	.000
405.	13.2089	1179.0874	.5621	89.264759	.969	.061	.000	.000
410.	13.0408	1158.1279	.5624	88.807889	.964	.072	.000	.000
415.	12.8641	1135.6473	.5632	88.280296	.958	.084	.000	.000
420.	12.6767	1111.3904	.5647	87.671625	.951	.098	.001	.000
425.	12.4761	1085.0153	.5671	86.967522	.942	.115	.001	.000
430.	12.2587	1056.1085	.5704	86.151899	.932	.135	.001	.000
435.	18.0626	1539.0091	.3827	85.204175	.921	.158	.001	.001
440.	18.0959	1521.8737	.3776	84.100288	.907	.186	.001	.001
445.	11.4490	948.0733	.5902	82.808210	.890	.219	.002	.001
450.	11.0973	902.0806	.6021	81.288103	.869	.260	.002	.001
455.	10.6866	849.4783	.6184	79.489927	.844	.310	.002	.001
460.	10.2146	790.1084	.6399	77.350660	.812	.373	.003	.001
465.	9.7015	725.6581	.6665	74.798704	.772	.453	.004	.002
470.	9.1876	659.5281	.6963	71.784601	.720	.555	.004	.002
475.	8.7088	595.5674	.7269	68.386696	.657	.681	.005	.003
480.	8.2819	538.3584	.7564	65.004370	.588	.819	.006	.003
485.	7.9093	491.4971	.7839	62.141994	.523	.947	.007	.004
490.	7.5868	454.3592	.8088	59.888010	.468	1.057	.008	.004
495.	7.3081	424.4989	.8312	58.085869	.421	1.150	.009	.005
500.	7.0665	399.9424	.8510	56.597092	.379	1.231	.011	.005
505.	6.8557	379.3625	.8685	55.335015	.343	1.302	.012	.006
510.	6.6706	361.8539	.8838	54.245980	.310	1.366	.013	.007
515.	6.5067	346.7748	.8973	53.295152	.281	1.424	.015	.007
520.	6.3603	333.6521	.9091	52.458319	.254	1.476	.016	.008
525.	6.2286	322.1256	.9195	51.717495	.230	1.523	.018	.009
530.	6.1089	311.9153	.9287	51.058847	.208	1.565	.020	.010
535.	5.9994	302.7994	.9368	50.471314	.188	1.603	.022	.011
540.	5.8984	294.5993	.9440	49.945828	.169	1.638	.024	.012
545.	5.8044	287.1684	.9505	49.474674	.153	1.668	.026	.013
550.	5.7162	280.3855	.9564	49.051254	.138	1.696	.028	.014

30.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	16.0850	1479.5120	.7604	91.980931	1.000	.001	.000	.000
300.	15.9789	1469.5804	.7527	91.970112	1.000	.001	.000	.000
305.	15.8738	1459.7224	.7453	91.957697	.999	.001	.000	.000
310.	15.7685	1449.7894	.7381	91.941998	.999	.002	.000	.000
315.	15.6621	1439.6967	.7314	91.922580	.999	.002	.000	.000
320.	15.5539	1429.3802	.7249	91.898411	.999	.003	.000	.000
325.	15.4438	1418.8140	.7189	91.869814	.998	.003	.000	.000
330.	15.3315	1407.9736	.7132	91.835089	.998	.004	.000	.000
335.	15.2171	1396.8317	.7078	91.793350	.998	.005	.000	.000
340.	15.1006	1385.3822	.7028	91.743487	.997	.006	.000	.000
345.	14.9820	1373.6102	.6981	91.683815	.996	.007	.000	.000
350.	14.8615	1361.5184	.6937	91.613673	.996	.009	.000	.000
355.	14.7391	1349.0875	.6896	91.530942	.995	.011	.000	.000
360.	14.6150	1336.3011	.6858	91.433759	.994	.013	.000	.000
365.	14.4890	1323.1363	.6823	91.319981	.992	.015	.000	.000
370.	14.3613	1309.5539	.6790	91.186520	.991	.018	.000	.000
375.	14.2317	1295.5368	.6761	91.032058	.989	.022	.000	.000
380.	14.1000	1281.0284	.6734	90.852777	.987	.025	.000	.000
385.	13.9662	1265.9713	.6710	90.645077	.985	.030	.000	.000
390.	13.8300	1250.2854	.6690	90.404019	.982	.035	.000	.000
395.	13.6909	1233.9228	.6672	90.127208	.979	.042	.000	.000
400.	13.5486	1216.7718	.6658	89.808116	.976	.049	.000	.000
405.	13.4024	1198.7251	.6647	89.440792	.971	.057	.000	.000
410.	13.2518	1179.6536	.6641	89.018125	.966	.067	.000	.000
415.	13.0959	1159.4003	.6639	88.531386	.961	.078	.000	.000
420.	12.9337	1137.8140	.6642	87.972940	.954	.091	.000	.000
425.	12.7638	1114.6699	.6652	87.330285	.947	.106	.001	.000
430.	12.5848	1089.7234	.6668	86.590274	.938	.124	.001	.000
435.	12.3947	1062.6759	.6692	85.736658	.927	.145	.001	.000
440.	12.1908	1033.2002	.6727	84.752230	.915	.169	.001	.001
445.	11.9703	1000.8726	.6774	83.613298	.900	.198	.001	.001
450.	18.1480	1493.4434	.4418	82.292547	.883	.233	.002	.001
455.	18.1829	1468.4302	.4361	80.758796	.862	.275	.002	.001
460.	11.1674	881.9560	.7024	78.976179	.836	.325	.002	.001
465.	10.8396	833.6655	.7159	76.909171	.805	.387	.003	.001
470.	10.4818	781.2587	.7324	74.534617	.767	.462	.004	.002
475.	10.1042	726.1945	.7518	71.870508	.722	.552	.004	.002
480.	9.7240	671.1517	.7731	69.020339	.669	.656	.005	.003
485.	9.3586	619.4646	.7950	66.191880	.613	.768	.006	.003
490.	9.0197	573.7087	.8164	63.605935	.557	.879	.007	.004
495.	8.7120	534.6485	.8367	61.369132	.505	.983	.008	.004
500.	8.4355	501.6760	.8555	59.471875	.457	1.076	.009	.005
505.	8.1880	473.7491	.8726	57.858640	.415	1.160	.010	.005
510.	7.9665	449.8999	.8881	56.473818	.376	1.235	.012	.006
515.	7.7677	429.3455	.9020	55.272890	.342	1.303	.013	.007
520.	7.5887	411.4764	.9144	54.222537	.310	1.365	.014	.007
525.	7.4265	395.8127	.9254	53.297144	.282	1.421	.016	.008
530.	7.2789	381.9816	.9353	52.477853	.255	1.472	.018	.009
535.	7.1437	369.6801	.9441	51.749206	.232	1.517	.019	.010
540.	7.0190	358.6637	.9520	51.098961	.210	1.559	.021	.011
545.	6.9033	348.7328	.9591	50.517137	.190	1.596	.023	.012
550.	6.7951	339.7200	.9655	49.995122	.172	1.630	.025	.013

35.0 MPa Isobar

Temp	Density		Z	Molecular	Composition			
K	mol/L	kg/m^3		mass	N2O4	NO2	NO	O2
295.	16.1574	1486.2078	.8832	91.983012	1.000	.001	.000	.000
300.	16.0520	1476.3462	.8742	91.972637	1.000	.001	.000	.000
305.	15.9483	1466.6201	.8654	91.961022	.999	.001	.000	.000
310.	15.8447	1456.8589	.8570	91.946242	.999	.002	.000	.000
315.	15.7403	1446.9688	.8490	91.927906	.999	.002	.000	.000
320.	15.6344	1436.8876	.8414	91.905468	.999	.002	.000	.000
325.	15.5268	1426.5709	.8342	91.877973	.999	.003	.000	.000
330.	15.4173	1416.0021	.8274	91.845162	.998	.004	.000	.000
335.	15.3058	1405.1596	.8210	91.805690	.998	.005	.000	.000
340.	15.1924	1394.0350	.8150	91.758531	.997	.006	.000	.000
345.	15.0773	1382.6150	.8093	91.702037	.997	.007	.000	.000
350.	14.9604	1370.9073	.8040	91.635752	.996	.008	.000	.000
355.	14.8420	1358.8953	.7990	91.557564	.995	.010	.000	.000
360.	14.7221	1346.5680	.7943	91.465759	.994	.012	.000	.000
365.	14.6008	1333.9085	.7899	91.358352	.993	.014	.000	.000
370.	14.4782	1320.8833	.7858	91.232329	.991	.017	.000	.000
375.	14.3543	1307.4862	.7820	91.086741	.990	.020	.000	.000
380.	14.2290	1293.6686	.7785	90.917904	.988	.024	.000	.000
385.	14.1022	1279.3865	.7753	90.722633	.986	.028	.000	.000
390.	13.9738	1264.5852	.7724	90.497158	.983	.033	.000	.000
395.	13.8435	1249.1896	.7698	90.236417	.980	.039	.000	.000
400.	13.7112	1233.1568	.7675	89.937848	.977	.046	.000	.000
405.	13.5765	1216.3847	.7656	89.594791	.973	.054	.000	.000
410.	13.4390	1198.7777	.7640	89.201181	.969	.063	.000	.000
415.	13.2983	1180.2216	.7628	88.749725	.963	.073	.000	.000
420.	13.1538	1160.5802	.7620	88.231617	.957	.085	.000	.000
425.	13.0048	1139.7309	.7616	87.639246	.950	.099	.000	.000
430.	12.8506	1117.4859	.7618	86.960141	.942	.115	.001	.000
435.	12.6901	1093.6325	.7626	86.179938	.933	.134	.001	.000
440.	12.5223	1068.0006	.7640	85.287645	.922	.156	.001	.000
445.	12.3459	1040.3010	.7662	84.262721	.909	.182	.001	.001
450.	12.1593	1010.2274	.7693	83.082628	.893	.212	.001	.001
455.	11.9607	977.5753	.7735	81.732083	.875	.248	.002	.001
460.	18.2021	1459.4260	.5028	80.178988	.853	.291	.002	.001
465.	18.2382	1429.9146	.4964	78.402049	.828	.342	.002	.001
470.	11.2746	861.2042	.7944	76.384599	.797	.403	.003	.001
475.	11.0118	816.3034	.8048	74.130054	.761	.475	.004	.002
480.	10.7336	769.3784	.8171	71.679255	.718	.559	.004	.002
485.	10.4452	722.0423	.8310	69.126975	.671	.652	.005	.003
490.	10.1540	676.3642	.8461	66.610417	.622	.751	.006	.003
495.	9.8688	634.1464	.8617	64.257944	.572	.850	.007	.004
500.	9.5965	596.3666	.8773	62.144237	.523	.945	.008	.004
505.	9.3417	563.1551	.8923	60.284058	.478	1.034	.009	.005
510.	9.1062	534.1566	.9064	58.658399	.437	1.117	.010	.005
515.	8.8901	508.8392	.9194	57.236720	.398	1.192	.012	.006
520.	8.6922	486.6643	.9313	55.988823	.363	1.261	.013	.007
525.	8.5109	467.1480	.9421	54.888340	.331	1.324	.014	.007
530.	8.3444	449.8807	.9518	53.913851	.301	1.381	.016	.008
535.	8.1911	434.5129	.9606	53.047127	.274	1.434	.018	.009
540.	8.0491	420.7598	.9685	52.273961	.249	1.482	.019	.010
545.	7.9171	408.3792	.9756	51.582124	.227	1.525	.021	.011
550.	7.7935	397.1721	.9821	50.961897	.206	1.565	.023	.012

40.0 MPa Isobar

Temp K	Density Mole/Liter	Density Kg/m^3)	Z	Moleculor Weight	Composition N2O4	NO2	NO	O2
295.	16.2325	1493.1470	1.0047	91.984889	1.000	.001	.000	.000
300.	16.1270	1483.2926	.9944	91.975777	1.000	.001	.000	.000
305.	16.0240	1473.6269	.9844	91.964015	.999	.001	.000	.000
310.	15.9216	1463.9904	.9747	91.950081	.999	.001	.000	.000
315.	15.8188	1454.2610	.9655	91.932735	.999	.002	.000	.000
320.	15.7148	1444.3695	.9567	91.911480	.999	.002	.000	.000
325.	15.6093	1434.2667	.9483	91.885364	.999	.003	.000	.000
330.	15.5021	1423.9366	.9404	91.854302	.998	.004	.000	.000
335.	15.3932	1413.3554	.9330	91.816892	.998	.004	.000	.000
340.	15.2826	1402.5156	.9259	91.772184	.997	.005	.000	.000
345.	15.1704	1391.4123	.9192	91.719042	.997	.006	.000	.000
350.	15.0567	1380.0358	.9129	91.655772	.996	.008	.000	.000
355.	14.9418	1368.3924	.9070	91.581685	.995	.009	.000	.000
360.	14.8256	1356.4680	.9014	91.494721	.994	.011	.000	.000
365.	14.7085	1344.2505	.8961	91.393028	.993	.014	.000	.000
370.	14.5903	1331.7107	.8912	91.273680	.992	.016	.000	.000
375.	14.4712	1318.8504	.8865	91.136012	.990	.019	.000	.000
380.	14.3513	1305.6272	.8822	90.976494	.989	.023	.000	.000
385.	14.2304	1292.0054	.8781	90.792183	.987	.027	.000	.000
390.	14.1085	1277.9411	.8744	90.579624	.984	.032	.000	.000
395.	13.9855	1263.3657	.8709	90.333822	.981	.037	.000	.000
400.	13.8613	1248.2575	.8677	90.053145	.978	.043	.000	.000
405.	13.7358	1232.5269	.8648	89.731222	.975	.051	.000	.000
410.	13.6086	1216.0966	.8623	89.362562	.970	.059	.000	.000
415.	13.4795	1198.8752	.8600	88.940686	.966	.069	.000	.000
420.	13.3482	1180.7476	.8581	88.457286	.960	.080	.000	.000
425.	13.2144	1161.6361	.8566	87.906821	.953	.093	.000	.000
430.	13.0776	1141.3902	.8555	87.278196	.946	.108	.000	.000
435.	12.9374	1119.8607	.8549	86.560173	.937	.125	.001	.000
440.	12.7931	1096.8879	.8547	85.740436	.927	.145	.001	.000
445.	12.6443	1072.2799	.8550	84.803734	.915	.168	.001	.000
450.	12.4901	1045.8631	.8560	83.735653	.902	.195	.001	.001
455.	12.3298	1017.4159	.8576	82.517123	.886	.227	.001	.001
460.	12.1625	986.7293	.8599	81.128790	.867	.265	.002	.001
465.	18.2216	1449.5870	.5678	79.553059	.844	.309	.002	.001
470.	18.2585	1420.0645	.5606	77.775716	.818	.361	.003	.001
475.	11.6107	880.0330	.8723	75.794692	.788	.422	.003	.002
480.	11.4082	839.9619	.8786	73.627981	.752	.492	.004	.002
485.	11.1964	798.5901	.8860	71.325472	.712	.571	.004	.002
490.	10.9767	757.0645	.8945	68.969832	.668	.658	.005	.003
495.	10.7516	716.7042	.9040	66.660342	.623	.748	.006	.003
500.	10.5244	678.6534	.9143	64.483988	.577	.840	.007	.004
505.	10.2991	643.6259	.9250	62.493275	.532	.928	.008	.004
510.	10.0797	611.8929	.9359	60.705378	.489	1.013	.009	.005
515.	9.8693	583.4102	.9465	59.113855	.449	1.092	.011	.005
520.	9.6698	557.9589	.9568	57.701214	.411	1.166	.012	.006
525.	9.4823	535.2444	.9664	56.446917	.376	1.234	.013	.007
530.	9.3068	514.9549	.9753	55.331260	.344	1.297	.015	.007
535.	9.1428	496.7877	.9836	54.336398	.315	1.355	.016	.008
540.	8.9896	480.4675	.9911	53.447105	.287	1.408	.018	.009
545.	8.8461	465.7459	.9979	52.650002	.262	1.456	.020	.010
550.	8.7112	452.4106	1.0041	51.934300	.239	1.501	.021	.011

Table B2. Isobaric Tables of N_2O_4 Properties Calculated With Equations From This Work.

14.696 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	89.9686	.0026	91.857403	.998	.003	.000	.000
70.10	89.9605	.0026	91.857327	.998	.003	.000	.000
70.10	.2084	.9639	79.157476	.838	.324	.001	.000
80.	.1981	.9829	76.723267	.801	.398	.000	.000
90.	.1875	.9840	74.055702	.757	.486	.000	.000
100.	.1769	.9851	71.233881	.708	.585	.000	.000
110.	.1666	.9863	68.358465	.653	.696	.000	.000
120.	.1567	.9875	65.514384	.593	.818	.000	.000
130.	.1475	.9886	62.792525	.531	.946	.000	.000
140.	.1383	.9897	59.949222	.463	1.077	.000	.000
150.	.1305	.9907	57.577897	.399	1.208	.000	.000
160.	.1235	.9917	55.419746	.337	1.332	.000	.000
170.	.1177	.9926	53.717376	.282	1.448	.000	.000
180.	.1126	.9934	52.234058	.231	1.551	.000	.000
190.	.1078	.9941	50.835611	.186	1.635	.000	.000
200.	.1039	.9948	49.794571	.149	1.707	.000	.000
210.	.1006	.9955	48.966399	.119	1.766	.000	.000
220.	.0975	.9961	48.193792	.094	1.807	.006	.003
230.	.0951	.9966	47.704550	.074	1.845	.006	.003
240.	.0929	.9970	47.327423	.059	1.875	.007	.003
250.	.0910	.9975	47.017847	.047	1.898	.008	.004
260.	.0892	.9978	46.771610	.037	1.915	.010	.005
270.	.0876	.9982	46.578020	.030	1.929	.011	.006
280.	.0861	.9984	46.418438	.024	1.939	.013	.006
290.	.0846	.9987	46.278302	.019	1.946	.015	.008
300.	.0833	.9989	46.170573	.016	1.951	.017	.009
310.	.0820	.9991	46.070552	.013	1.954	.020	.010
320.	.0808	.9993	45.983415	.010	1.956	.023	.011
330.	.0797	.9994	45.902000	.009	1.957	.026	.013
340.	.0785	.9995	45.824741	.007	1.956	.030	.015
350.	.0774	.9996	45.749648	.006	1.954	.034	.017
360.	.0763	.9997	45.675134	.005	1.952	.039	.019
370.	.0753	.9997	45.598628	.004	1.948	.044	.022
380.	.0743	.9998	45.522009	.003	1.944	.049	.025
390.	.0733	.9998	45.441441	.003	1.939	.055	.028
400.	.0723	.9998	45.356813	.002	1.933	.062	.031
410.	.0713	.9999	45.267463	.002	1.927	.069	.035
420.	.0703	.9999	45.172764	.002	1.919	.077	.039
430.	.0694	.9999	45.072240	.001	1.911	.086	.043
440.	.0685	.9999	44.965486	.001	1.902	.095	.048
450.	.0675	.9999	44.852085	.001	1.893	.105	.053
460.	.0666	.9999	44.731625	.001	1.882	.116	.058
470.	.0657	.9999	44.603762	.001	1.871	.127	.064
480.	.0648	.9999	44.468242	.001	1.859	.140	.070
490.	.0639	.9999	44.324899	.001	1.846	.153	.077
500.	.0630	.9999	44.173625	.000	1.832	.167	.084

20.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.0403	.0036	91.927668	.999	.002	.000	.000
80.	89.2628	.0036	91.916724	.999	.002	.000	.000
82.23	89.0877	.0035	91.913552	.999	.002	.000	.000
82.23	.2747	.9629	77.997765	.820	.359	.000	.000
90.	.2638	.9779	76.067481	.790	.419	.000	.000
100.	.2497	.9795	73.436018	.747	.507	.000	.000
110.	.2357	.9811	70.669785	.697	.606	.000	.000
120.	.2221	.9827	67.874396	.643	.716	.000	.000
130.	.2091	.9843	65.124931	.585	.835	.000	.000
140.	.1965	.9858	62.319552	.522	.960	.000	.000
150.	.1850	.9872	59.749199	.458	1.088	.000	.000
160.	.1747	.9885	57.406115	.395	1.214	.000	.000
170.	.1656	.9897	55.384034	.336	1.334	.000	.000
180.	.1577	.9909	53.649131	.281	1.445	.000	.000
190.	.1512	.9919	52.295651	.234	1.546	.000	.000
200.	.1449	.9929	50.922536	.189	1.629	.000	.000
210.	.1397	.9938	49.893514	.153	1.699	.000	.000
220.	.1353	.9946	49.066562	.123	1.758	.000	.000
230.	.1312	.9953	48.303301	.098	1.800	.005	.003
240.	.1279	.9959	47.806437	.078	1.838	.006	.003
250.	.1249	.9965	47.407524	.063	1.868	.007	.004
260.	.1223	.9970	47.090440	.050	1.891	.008	.004
270.	.1199	.9974	46.835824	.040	1.910	.010	.005
280.	.1176	.9978	46.561888	.032	1.919	.017	.008
290.	.1157	.9982	46.462147	.026	1.934	.013	.007
300.	.1138	.9985	46.318316	.021	1.942	.016	.008
310.	.1120	.9987	46.200545	.017	1.947	.018	.009
320.	.1103	.9990	46.095748	.014	1.951	.021	.010
330.	.1087	.9992	46.002803	.012	1.953	.024	.012
340.	.1071	.9993	45.916374	.010	1.954	.027	.014
350.	.1056	.9994	45.836208	.008	1.953	.031	.015
360.	.1041	.9995	45.758256	.007	1.952	.035	.017
370.	.1027	.9996	45.681530	.005	1.950	.040	.020
380.	.1013	.9997	45.604342	.005	1.946	.045	.022
390.	.0999	.9997	45.525353	.004	1.942	.050	.025
400.	.0985	.9998	45.444020	.003	1.937	.056	.028
410.	.0972	.9998	45.359040	.003	1.932	.063	.031
420.	.0959	.9998	45.269785	.002	1.926	.070	.035
430.	.0947	.9998	45.175626	.002	1.918	.078	.039
440.	.0934	.9998	45.076086	.002	1.911	.086	.043
450.	.0922	.9998	44.970755	.001	1.902	.095	.048
460.	.0909	.9998	44.859219	.001	1.893	.105	.052
470.	.0897	.9998	44.741076	.001	1.883	.115	.058
480.	.0885	.9998	44.615984	.001	1.872	.127	.063
490.	.0873	.9998	44.483696	.001	1.860	.139	.069
500.	.0861	.9998	44.344040	.001	1.847	.151	.076

30.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.0475	.0054	91.929521	.999	.002	.000	.000
80.	89.2711	.0053	91.919325	.999	.002	.000	.000
90.	88.4805	.0053	91.903537	.999	.002	.000	.000
98.99	87.7502	.0052	91.882784	.999	.003	.000	.000
98.99	.3947	.9664	76.363916	.795	.410	.000	.000
100.	.3926	.9684	76.115841	.791	.418	.000	.000
110.	.3719	.9710	73.584470	.749	.502	.000	.000
120.	.3514	.9734	70.926278	.702	.597	.000	.000
130.	.3315	.9759	68.235929	.650	.701	.000	.000
140.	.3126	.9782	65.579971	.595	.815	.000	.000
150.	.2940	.9803	62.862858	.535	.934	.000	.000
160.	.2772	.9824	60.351479	.474	1.056	.000	.000
170.	.2618	.9843	58.039733	.413	1.178	.000	.000
180.	.2483	.9860	56.018017	.355	1.295	.000	.000
190.	.2364	.9876	54.259905	.301	1.405	.000	.000
200.	.2265	.9891	52.861158	.253	1.506	.000	.000
210.	.2168	.9905	51.442812	.208	1.591	.000	.000
220.	.2089	.9917	50.356741	.170	1.665	.000	.000
230.	.2014	.9928	49.315984	.137	1.720	.006	.003
240.	.1956	.9937	48.643914	.111	1.772	.006	.003
250.	.1905	.9946	48.097216	.090	1.814	.006	.003
260.	.1860	.9954	47.658077	.073	1.847	.007	.004
270.	.1819	.9961	47.299869	.059	1.874	.009	.004
280.	.1783	.9967	47.014172	.048	1.895	.010	.005
290.	.1749	.9972	46.779772	.039	1.911	.012	.006
300.	.1718	.9976	46.586713	.032	1.923	.013	.007
310.	.1690	.9980	46.425371	.026	1.933	.016	.008
320.	.1662	.9984	46.289347	.021	1.940	.018	.009
330.	.1637	.9987	46.171564	.017	1.945	.021	.010
340.	.1612	.9989	46.067256	.014	1.948	.024	.012
350.	.1589	.9991	45.972429	.012	1.949	.027	.013
360.	.1566	.9992	45.885209	.010	1.950	.030	.015
370.	.1544	.9994	45.802038	.008	1.949	.034	.017
380.	.1523	.9995	45.721415	.007	1.947	.039	.019
390.	.1502	.9996	45.641580	.006	1.945	.044	.022
400.	.1482	.9996	45.561125	.005	1.941	.049	.025
410.	.1462	.9997	45.479208	.004	1.937	.055	.027
420.	.1443	.9997	45.394630	.004	1.932	.061	.031
430.	.1424	.9997	45.306646	.003	1.926	.068	.034
440.	.1405	.9997	45.214564	.003	1.920	.075	.038
450.	.1387	.9997	45.117852	.002	1.912	.083	.042
460.	.1369	.9997	45.016388	.002	1.904	.092	.046
470.	.1351	.9997	44.909086	.002	1.896	.101	.051
480.	.1333	.9997	44.795686	.001	1.886	.111	.056
490.	.1316	.9997	44.676304	.001	1.876	.122	.061
500.	.1298	.9997	44.550395	.001	1.865	.133	.066

40.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.0539	.0072	91.930460	.999	.002	.000	.000
80.	89.2781	.0071	91.920646	.999	.002	.000	.000
90.	88.4884	.0070	91.905398	.999	.002	.000	.000
100.	87.6757	.0070	91.882629	.999	.003	.000	.000
110.	86.8333	.0069	91.850125	.998	.003	.000	.000
111.46	86.7077	.0068	91.844445	.998	.003	.000	.000
111.46	.5104	.9466	75.136480	.775	.449	.000	.000
120.	.4871	.9637	73.005588	.739	.522	.000	.000
130.	.4603	.9670	70.412826	.693	.616	.000	.000
140.	.4344	.9702	67.796481	.642	.720	.000	.000
150.	.4090	.9732	65.109196	.586	.831	.000	.000
160.	.3855	.9760	62.544004	.528	.947	.000	.000
170.	.3637	.9786	60.122336	.468	1.066	.000	.000
180.	.3441	.9810	57.935378	.410	1.184	.000	.000
190.	.3264	.9832	55.934642	.353	1.297	.000	.000
200.	.3110	.9852	54.222656	.301	1.403	.000	.000
210.	.2984	.9870	52.920730	.255	1.502	.000	.000
220.	.2858	.9886	51.529035	.211	1.585	.000	.000
230.	.2752	.9901	50.414024	.173	1.656	.000	.000
240.	.2657	.9914	49.443862	.141	1.713	.005	.002
250.	.2580	.9926	48.751285	.115	1.764	.006	.003
260.	.2512	.9937	48.198891	.094	1.806	.006	.003
270.	.2452	.9946	47.746090	.077	1.839	.008	.004
280.	.2399	.9954	47.382049	.062	1.866	.009	.004
290.	.2350	.9961	47.082330	.051	1.888	.011	.005
300.	.2306	.9967	46.840816	.042	1.905	.012	.006
310.	.2265	.9973	46.638124	.034	1.918	.014	.007
320.	.2227	.9977	46.470558	.028	1.928	.016	.008
330.	.2191	.9981	46.326549	.023	1.935	.019	.009
340.	.2157	.9984	46.202853	.019	1.941	.021	.011
350.	.2125	.9987	46.093083	.016	1.944	.024	.012
360.	.2094	.9989	45.993905	.013	1.946	.028	.014
370.	.2064	.9991	45.902026	.011	1.947	.031	.016
380.	.2035	.9992	45.815440	.009	1.946	.035	.018
390.	.2008	.9994	45.732051	.008	1.945	.040	.020
400.	.1980	.9994	45.649910	.007	1.942	.044	.022
410.	.1954	.9995	45.567591	.006	1.939	.050	.025
420.	.1928	.9995	45.484359	.005	1.935	.055	.028
430.	.1903	.9996	45.398884	.004	1.930	.062	.031
440.	.1878	.9996	45.310445	.003	1.925	.068	.034
450.	.1854	.9996	45.218341	.003	1.918	.076	.038
460.	.1830	.9996	45.122307	.003	1.911	.084	.042
470.	.1806	.9996	45.021382	.002	1.904	.092	.046
480.	.1783	.9995	44.915308	.002	1.895	.101	.051
490.	.1759	.9995	44.803715	.002	1.886	.111	.055
500.	.1736	.9995	44.686217	.001	1.876	.121	.061

50.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.0599	.0090	91.931034	.999	.002	.000	.000
80.	89.2847	.0089	91.921455	.999	.002	.000	.000
90.	88.4956	.0088	91.906543	.999	.002	.000	.000
100.	87.6837	.0087	91.884257	.999	.003	.000	.000
110.	86.8424	.0087	91.852465	.998	.003	.000	.000
120.	85.9664	.0086	91.809160	.998	.004	.000	.000
121.47	85.8343	.0085	91.801696	.998	.004	.000	.000
121.47	.6234	.9403	74.193600	.760	.481	.000	.000
130.	.5945	.9578	72.057444	.723	.555	.000	.000
140.	.5614	.9619	69.503776	.675	.651	.000	.000
150.	.5294	.9657	66.901457	.624	.755	.000	.000
160.	.4990	.9693	64.331997	.568	.866	.000	.000
170.	.4706	.9727	61.858538	.511	.980	.000	.000
180.	.4445	.9757	59.537884	.453	1.096	.000	.000
190.	.4208	.9785	57.414911	.396	1.210	.000	.000
200.	.4000	.9811	55.553935	.342	1.320	.000	.000
210.	.3816	.9834	53.932234	.292	1.421	.000	.000
220.	.3677	.9855	52.858383	.250	1.520	.000	.000
230.	.3512	.9874	51.327616	.205	1.594	.000	.000
240.	.3379	.9890	50.177674	.168	1.659	.005	.002
250.	.3273	.9905	49.374928	.139	1.717	.005	.002
260.	.3180	.9919	48.715442	.114	1.766	.006	.003
270.	.3085	.9931	47.981044	.092	1.796	.020	.010
280.	.3025	.9941	47.737048	.077	1.839	.008	.004
290.	.2959	.9950	47.378196	.063	1.865	.010	.005
300.	.2900	.9958	47.087093	.051	1.886	.011	.006
310.	.2846	.9964	46.845025	.042	1.903	.013	.006
320.	.2796	.9970	46.644998	.035	1.915	.015	.007
330.	.2749	.9975	46.475709	.029	1.925	.017	.009
340.	.2705	.9979	46.330392	.024	1.933	.020	.010
350.	.2663	.9983	46.204443	.020	1.938	.023	.011
360.	.2624	.9986	46.092929	.016	1.941	.026	.013
370.	.2586	.9988	45.992299	.014	1.943	.029	.014
380.	.2550	.9990	45.898592	.012	1.944	.033	.016
390.	.2514	.9991	45.809991	.010	1.944	.037	.018
400.	.2480	.9992	45.724285	.008	1.942	.041	.021
410.	.2447	.9993	45.640506	.007	1.940	.046	.023
420.	.2415	.9994	45.556422	.006	1.937	.051	.026
430.	.2383	.9994	45.471849	.005	1.933	.057	.029
440.	.2352	.9994	45.385078	.004	1.928	.064	.032
450.	.2321	.9994	45.295535	.004	1.922	.070	.035
460.	.2291	.9994	45.202745	.003	1.916	.078	.039
470.	.2262	.9994	45.105874	.003	1.909	.085	.043
480.	.2233	.9994	45.004517	.002	1.901	.094	.047
490.	.2204	.9994	44.898252	.002	1.893	.103	.051
500.	.2176	.9994	44.786719	.002	1.884	.113	.056

60.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.0658	.0108	91.931427	.999	.002	.000	.000
80.	89.2910	.0107	91.922010	.999	.002	.000	.000
90.	88.5024	.0106	91.907329	.999	.002	.000	.000
100.	87.6913	.0105	91.885377	.999	.003	.000	.000
110.	86.8508	.0104	91.854076	.998	.003	.000	.000
120.	85.9760	.0103	91.811498	.998	.004	.000	.000
129.89	85.0735	.0102	91.756581	.997	.005	.000	.000
129.89	.7341	.9479	73.390018	.746	.508	.000	.000
130.	.7337	.9481	73.362179	.746	.509	.000	.000
140.	.6933	.9532	70.877451	.701	.598	.000	.000
150.	.6544	.9580	68.361643	.653	.696	.000	.000
160.	.6166	.9624	65.772740	.600	.802	.000	.000
170.	.5832	.9665	63.481724	.547	.913	.000	.000
180.	.5487	.9702	60.908816	.488	1.026	.000	.000
190.	.5189	.9737	58.703590	.432	1.139	.000	.000
200.	.4923	.9768	56.733532	.377	1.249	.000	.000
210.	.4687	.9796	54.989599	.325	1.354	.000	.000
220.	.4479	.9822	53.475964	.277	1.451	.000	.000
230.	.4303	.9845	52.253345	.235	1.540	.000	.000
240.	.4131	.9865	50.999909	.195	1.613	.000	.000
250.	.3983	.9884	49.962871	.161	1.674	.005	.002
260.	.3862	.9900	49.206623	.133	1.729	.006	.003
270.	.3749	.9914	48.501065	.109	1.771	.012	.006
280.	.3661	.9927	48.079744	.090	1.812	.008	.004
290.	.3577	.9938	47.667509	.074	1.843	.009	.004
300.	.3501	.9948	47.324084	.061	1.868	.011	.005
310.	.3433	.9956	47.046888	.050	1.887	.012	.006
320.	.3370	.9963	46.814656	.041	1.903	.014	.007
330.	.3311	.9969	46.620137	.034	1.915	.016	.008
340.	.3257	.9974	46.454206	.028	1.925	.019	.009
350.	.3205	.9978	46.312478	.024	1.932	.021	.011
360.	.3156	.9982	46.187761	.020	1.936	.024	.012
370.	.3110	.9984	46.076375	.017	1.940	.027	.014
380.	.3065	.9987	45.974781	.014	1.941	.031	.015
390.	.3023	.9989	45.880362	.012	1.942	.035	.017
400.	.2981	.9990	45.790820	.010	1.941	.039	.019
410.	.2941	.9991	45.704133	.008	1.940	.043	.022
420.	.2902	.9992	45.618728	.007	1.937	.048	.024
430.	.2864	.9992	45.533512	.006	1.934	.054	.027
440.	.2827	.9992	45.447227	.005	1.930	.060	.030
450.	.2790	.9992	45.359000	.004	1.925	.066	.033
460.	.2754	.9992	45.268042	.004	1.919	.073	.037
470.	.2719	.9992	45.173964	.003	1.913	.080	.040
480.	.2684	.9992	45.075863	.003	1.906	.088	.044
490.	.2650	.9992	44.973393	.002	1.898	.097	.048
500.	.2616	.9992	44.866149	.002	1.890	.106	.053

80.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.1022	.0144	91.957465	.999	.001	.000	.000
80.	89.3032	.0142	91.922738	.999	.002	.000	.000
90.	88.5156	.0141	91.908365	.999	.002	.000	.000
100.	87.7056	.0140	91.886857	.999	.003	.000	.000
110.	86.8666	.0138	91.856202	.998	.003	.000	.000
120.	85.9935	.0137	91.814574	.998	.004	.000	.000
130.	85.0826	.0136	91.760340	.997	.005	.000	.000
140.	84.1308	.0135	91.691671	.997	.007	.000	.000
143.60	83.7777	.0134	91.662994	.996	.007	.000	.000
143.60	.9510	.9273	72.119429	.724	.553	.000	.000
150.	.9165	.9414	70.561345	.695	.610	.000	.000
160.	.8642	.9477	68.077635	.648	.706	.000	.000
170.	.8146	.9534	65.600697	.596	.809	.000	.000
180.	.7682	.9587	63.186360	.543	.917	.000	.000
190.	.7252	.9635	60.887057	.488	1.027	.000	.000
200.	.6860	.9678	58.747012	.433	1.137	.000	.000
210.	.6507	.9717	56.797941	.379	1.243	.000	.000
220.	.6196	.9753	55.088585	.329	1.345	.000	.000
230.	.5926	.9784	53.640527	.282	1.440	.000	.000
240.	.5720	.9813	52.682157	.244	1.533	.000	.000
250.	.5450	.9838	51.042305	.200	1.595	.005	.003
260.	.5267	.9860	50.137341	.167	1.660	.005	.003
270.	.5106	.9880	49.373238	.139	1.715	.006	.003
280.	.4964	.9897	48.745898	.116	1.762	.007	.003
290.	.4838	.9912	48.224025	.096	1.800	.008	.004
300.	.4725	.9925	47.793887	.079	1.832	.009	.005
310.	.4624	.9937	47.439086	.066	1.858	.011	.005
320.	.4532	.9947	47.144001	.055	1.878	.013	.006
330.	.4448	.9955	46.899713	.045	1.895	.014	.007
340.	.4370	.9962	46.693679	.038	1.908	.017	.008
350.	.4297	.9968	46.518006	.031	1.918	.019	.010
360.	.4229	.9973	46.366705	.026	1.926	.022	.011
370.	.4164	.9977	46.234083	.022	1.931	.025	.012
380.	.4103	.9980	46.115819	.019	1.935	.028	.014
390.	.4044	.9982	46.008226	.016	1.937	.031	.016
400.	.3987	.9984	45.908906	.013	1.938	.035	.018
410.	.3933	.9986	45.815283	.011	1.938	.039	.020
420.	.3880	.9987	45.725188	.010	1.937	.044	.022
430.	.3829	.9988	45.637019	.008	1.935	.049	.024
440.	.3779	.9988	45.549693	.007	1.932	.054	.027
450.	.3730	.9988	45.461862	.006	1.928	.060	.030
460.	.3682	.9988	45.372634	.005	1.923	.066	.033
470.	.3635	.9988	45.281322	.004	1.918	.073	.037
480.	.3589	.9988	45.187120	.004	1.912	.080	.040
490.	.3544	.9988	45.089498	.003	1.905	.088	.044
500.	.3499	.9988	44.987963	.003	1.898	.096	.048

100.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.1134	.0180	91.957750	.999	.001	.000	.000
80.	89.3350	.0178	91.943654	.999	.002	.000	.000
90.	88.5285	.0176	91.909044	.999	.002	.000	.000
100.	87.7195	.0174	91.887830	.999	.003	.000	.000
110.	86.8816	.0173	91.857592	.998	.003	.000	.000
120.	86.0100	.0172	91.816582	.998	.004	.000	.000
130.	85.1010	.0170	91.763235	.997	.005	.000	.000
140.	84.1514	.0169	91.695838	.997	.007	.000	.000
150.	83.1537	.0168	91.608141	.996	.008	.000	.000
154.61	82.6805	.0167	91.564599	.995	.009	.000	.000
154.61	1.1637	.9192	71.133039	.706	.589	.000	.000
160.	1.1273	.9317	69.844478	.682	.638	.000	.000
170.	1.0617	.9393	67.382910	.634	.734	.000	.000
180.	1.0003	.9462	64.970727	.583	.835	.000	.000
190.	.9432	.9525	62.634003	.530	.941	.000	.000
200.	.8908	.9581	60.419319	.476	1.049	.000	.000
210.	.8431	.9632	58.363717	.423	1.156	.000	.000
220.	.8007	.9678	56.522859	.371	1.259	.000	.000
230.	.7630	.9719	54.886172	.322	1.357	.000	.000
240.	.7298	.9756	53.455855	.277	1.448	.000	.000
250.	.7022	.9788	52.345377	.238	1.533	.000	.000
260.	.6727	.9817	51.003356	.198	1.599	.005	.002
270.	.6499	.9843	50.089734	.166	1.661	.007	.003
280.	.6305	.9865	49.373415	.139	1.715	.006	.003
290.	.6131	.9884	48.756437	.116	1.760	.007	.004
300.	.5977	.9901	48.243293	.097	1.798	.008	.004
310.	.5827	.9916	47.723513	.080	1.824	.016	.008
320.	.5714	.9929	47.465011	.067	1.854	.012	.006
330.	.5601	.9939	47.171722	.056	1.875	.013	.007
340.	.5496	.9949	46.924507	.047	1.891	.015	.008
350.	.5400	.9956	46.716364	.039	1.904	.018	.009
360.	.5311	.9963	46.538009	.033	1.915	.020	.010
370.	.5227	.9968	46.383365	.028	1.922	.023	.011
380.	.5147	.9972	46.247822	.023	1.928	.026	.013
390.	.5071	.9975	46.126541	.020	1.932	.029	.014
400.	.4999	.9978	46.016250	.017	1.934	.032	.016
410.	.4930	.9980	45.914118	.014	1.935	.036	.018
420.	.4863	.9982	45.817659	.012	1.935	.041	.020
430.	.4798	.9983	45.725359	.010	1.934	.045	.023
440.	.4735	.9983	45.635073	.009	1.932	.050	.025
450.	.4673	.9984	45.546022	.008	1.929	.056	.028
460.	.4613	.9984	45.456649	.006	1.925	.062	.031
470.	.4555	.9984	45.366132	.006	1.921	.068	.034
480.	.4497	.9984	45.273817	.005	1.916	.075	.037
490.	.4440	.9984	45.178863	.004	1.910	.082	.041
500.	.4384	.9984	45.080754	.004	1.903	.090	.045

150.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.1411	.0269	91.958235	.999	.001	.000	.000
80.	89.3645	.0266	91.944378	.999	.002	.000	.000
90.	88.5740	.0264	91.924716	.999	.002	.000	.000
100.	87.7618	.0262	91.898339	.999	.003	.000	.000
110.	86.9181	.0259	91.859804	.998	.003	.000	.000
120.	86.0495	.0257	91.819731	.998	.004	.000	.000
130.	85.1442	.0255	91.767706	.997	.005	.000	.000
140.	84.1989	.0254	91.702172	.997	.007	.000	.000
150.	83.2100	.0252	91.620997	.996	.008	.000	.000
160.	82.1721	.0251	91.519967	.995	.010	.000	.000
170.	81.0820	.0250	91.398963	.993	.013	.000	.000
175.50	80.4567	.0248	91.321087	.993	.014	.000	.000
175.50	1.6850	.8992	69.337326	.672	.656	.000	.000
180.	1.6379	.9108	68.271301	.652	.697	.000	.000
190.	1.5396	.9215	65.941189	.604	.793	.000	.000
200.	1.4490	.9310	63.663971	.554	.893	.000	.000
210.	1.3659	.9395	61.482100	.503	.995	.000	.000
220.	1.2905	.9471	59.429649	.451	1.098	.000	.000
230.	1.2210	.9538	57.458815	.400	1.198	.002	.001
240.	1.1607	.9598	55.763215	.351	1.295	.003	.001
250.	1.0987	.9650	53.832622	.300	1.379	.020	.010
260.	1.0634	.9697	53.090660	.265	1.472	.000	.000
270.	1.0184	.9738	51.767835	.225	1.543	.006	.003
280.	.9827	.9774	50.826127	.192	1.610	.005	.003
290.	.9508	.9805	50.002006	.163	1.668	.006	.003
300.	.9227	.9833	49.307804	.137	1.718	.007	.004
310.	.8978	.9856	48.724016	.116	1.760	.008	.004
320.	.8756	.9877	48.235504	.097	1.796	.010	.005
330.	.8556	.9894	47.826297	.082	1.825	.011	.006
340.	.8376	.9909	47.482665	.069	1.850	.013	.007
350.	.8212	.9922	47.193827	.058	1.869	.015	.008
360.	.8061	.9932	46.948702	.049	1.886	.017	.009
370.	.7921	.9941	46.739068	.041	1.898	.020	.010
380.	.7791	.9948	46.558403	.035	1.908	.022	.011
390.	.7669	.9954	46.400332	.029	1.916	.025	.013
400.	.7553	.9959	46.260496	.025	1.922	.028	.014
410.	.7443	.9962	46.134992	.021	1.926	.032	.016
420.	.7338	.9965	46.020233	.018	1.928	.035	.018
430.	.7237	.9967	45.913643	.016	1.930	.039	.020
440.	.7140	.9969	45.813120	.013	1.930	.044	.022
450.	.7046	.9970	45.716631	.011	1.929	.048	.024
460.	.6955	.9971	45.622836	.010	1.927	.054	.027
470.	.6865	.9971	45.530267	.009	1.924	.059	.030
480.	.6778	.9972	45.437874	.007	1.920	.065	.032
490.	.6693	.9972	45.344818	.006	1.916	.071	.036
500.	.6609	.9972	45.250230	.006	1.911	.078	.039

200.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.1687	.0359	91.958578	.999	.001	.000	.000
80.	89.3937	.0355	91.944908	.999	.002	.000	.000
90.	88.6052	.0352	91.925482	.999	.002	.000	.000
100.	87.7951	.0349	91.899417	.999	.003	.000	.000
110.	86.9538	.0346	91.861280	.998	.003	.000	.000
120.	86.0880	.0343	91.821803	.998	.004	.000	.000
130.	85.1858	.0340	91.770589	.997	.005	.000	.000
140.	84.2441	.0338	91.706160	.997	.007	.000	.000
150.	83.2595	.0336	91.626497	.996	.008	.000	.000
160.	82.2268	.0335	91.527539	.995	.010	.000	.000
170.	81.1430	.0333	91.409317	.993	.013	.000	.000
180.	79.9980	.0332	91.264684	.992	.016	.000	.000
190.	78.7825	.0332	91.088946	.990	.019	.000	.000
191.03	78.6525	.0327	91.068815	.990	.020	.000	.000
191.03	2.2005	.8742	68.091032	.648	.705	.000	.000
200.	2.0756	.8992	66.060186	.607	.788	.000	.000
210.	1.9485	.9119	63.845932	.558	.885	.000	.000
220.	1.8305	.9231	61.621874	.508	.983	.002	.001
230.	1.7270	.9329	59.621789	.458	1.083	.002	.001
240.	1.6349	.9416	57.790551	.409	1.181	.002	.001
250.	1.5524	.9492	56.109988	.361	1.275	.002	.001
260.	1.4794	.9559	54.608910	.317	1.364	.003	.002
270.	1.4146	.9618	53.266394	.275	1.446	.005	.002
280.	1.3643	.9669	52.354662	.240	1.526	.000	.000
290.	1.3089	.9714	51.146043	.204	1.588	.005	.003
300.	1.2652	.9753	50.297233	.174	1.646	.006	.003
310.	1.2266	.9787	49.576825	.148	1.697	.007	.004
320.	1.1906	.9816	48.890310	.125	1.738	.013	.007
330.	1.1620	.9841	48.453979	.106	1.778	.010	.005
340.	1.1348	.9863	48.020681	.090	1.809	.012	.006
350.	1.1102	.9881	47.654678	.076	1.835	.013	.007
360.	1.0878	.9896	47.344956	.064	1.856	.015	.008
370.	1.0674	.9909	47.081310	.054	1.874	.018	.009
380.	1.0485	.9919	46.855272	.046	1.888	.020	.010
390.	1.0309	.9928	46.659853	.039	1.899	.022	.011
400.	1.0145	.9935	46.489133	.033	1.908	.025	.013
410.	.9990	.9941	46.338195	.028	1.915	.028	.014
420.	.9843	.9945	46.202938	.024	1.920	.032	.016
430.	.9703	.9948	46.079965	.021	1.923	.035	.018
440.	.9569	.9951	45.966397	.018	1.925	.039	.020
450.	.9440	.9953	45.860032	.015	1.925	.044	.022
460.	.9315	.9955	45.758704	.013	1.925	.048	.024
470.	.9194	.9956	45.660983	.012	1.923	.053	.027
480.	.9077	.9957	45.565322	.010	1.921	.059	.029
490.	.8962	.9958	45.470600	.009	1.918	.065	.032
500.	.8849	.9958	45.375907	.008	1.914	.071	.035

250.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.1961	.0448	91.958859	.999	.001	.000	.000
80.	89.4229	.0444	91.945351	.999	.002	.000	.000
90.	88.6361	.0440	91.926127	.999	.002	.000	.000
100.	87.8282	.0436	91.900314	.999	.002	.000	.000
110.	86.9935	.0432	91.867080	.998	.003	.000	.000
120.	86.1259	.0428	91.823439	.998	.004	.000	.000
130.	85.2267	.0425	91.772827	.997	.005	.000	.000
140.	84.2883	.0423	91.709200	.997	.007	.000	.000
150.	83.3078	.0420	91.630608	.996	.008	.000	.000
160.	82.2795	.0418	91.533081	.995	.010	.000	.000
170.	81.2011	.0417	91.416786	.994	.013	.000	.000
180.	80.0628	.0415	91.274707	.992	.016	.000	.000
190.	78.8555	.0414	91.102358	.990	.019	.000	.000
200.	77.5657	.0414	90.894041	.988	.024	.001	.000
203.51	77.0911	.0410	90.811241	.987	.025	.001	.000
203.51	2.7168	.8599	67.155249	.629	.742	.000	.000
210.	2.5984	.8798	65.717350	.600	.802	.000	.000
220.	2.4303	.8955	63.496961	.551	.896	.001	.000
230.	2.2824	.9092	61.431990	.503	.993	.001	.001
240.	2.1508	.9211	59.495202	.454	1.090	.002	.001
250.	2.0337	.9314	57.701112	.406	1.185	.002	.001
260.	1.9302	.9405	56.076892	.360	1.276	.003	.001
270.	1.8387	.9483	54.615990	.317	1.363	.003	.002
280.	1.7583	.9552	53.324917	.276	1.443	.004	.002
290.	1.6971	.9612	52.493998	.243	1.522	.000	.000
300.	1.6253	.9664	51.217658	.206	1.581	.006	.003
310.	1.5707	.9709	50.383266	.177	1.639	.007	.003
320.	1.5183	.9748	49.531301	.150	1.685	.015	.008
330.	1.4797	.9781	49.058620	.129	1.733	.009	.005
340.	1.4416	.9810	48.542267	.110	1.770	.011	.005
350.	1.4075	.9834	48.104166	.093	1.801	.012	.006
360.	1.3767	.9854	47.732266	.079	1.827	.014	.007
370.	1.3487	.9872	47.415779	.067	1.849	.016	.008
380.	1.3231	.9886	47.145091	.057	1.867	.018	.009
390.	1.2995	.9898	46.912194	.049	1.882	.021	.010
400.	1.2776	.9908	46.710164	.042	1.893	.023	.012
410.	1.2572	.9915	46.533213	.036	1.903	.026	.013
420.	1.2379	.9922	46.376487	.031	1.910	.029	.015
430.	1.2196	.9927	46.235942	.026	1.915	.033	.016
440.	1.2023	.9931	46.108190	.023	1.918	.036	.018
450.	1.1856	.9934	45.990389	.019	1.921	.040	.020
460.	1.1696	.9936	45.880173	.017	1.922	.045	.022
470.	1.1542	.9938	45.775574	.015	1.921	.049	.025
480.	1.1392	.9940	45.674918	.013	1.920	.054	.027
490.	1.1246	.9942	45.576803	.011	1.918	.060	.030
500.	1.1104	.9943	45.480034	.010	1.915	.066	.033

300.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.2236	.0538	91.959110	.999	.001	.000	.000
80.	89.4519	.0532	91.945745	.999	.002	.000	.000
90.	88.6670	.0527	91.926707	.999	.002	.000	.000
100.	87.8611	.0522	91.901116	.999	.002	.000	.000
110.	87.0286	.0518	91.868160	.998	.003	.000	.000
120.	86.1635	.0514	91.824843	.998	.004	.000	.000
130.	85.2671	.0510	91.774738	.997	.005	.000	.000
140.	84.3320	.0507	91.711757	.997	.007	.000	.000
150.	83.3551	.0504	91.634014	.996	.008	.000	.000
160.	82.3322	.0502	91.538909	.995	.010	.000	.000
170.	81.2578	.0500	91.422795	.994	.013	.000	.000
180.	80.1257	.0498	91.282673	.992	.016	.000	.000
190.	78.9255	.0497	91.112893	.990	.019	.000	.000
200.	77.6448	.0496	90.907941	.988	.024	.000	.000
210.	76.2666	.0496	90.660716	.985	.029	.001	.000
213.98	75.6868	.0492	90.549119	.984	.031	.001	.000
213.98	3.2377	.8437	66.416988	.614	.772	.000	.000
220.	3.0973	.8639	65.050352	.586	.827	.001	.001
230.	2.8931	.8822	62.964122	.539	.920	.001	.001
240.	2.7131	.8980	60.972959	.492	1.015	.002	.001
250.	2.5436	.9115	58.856962	.441	1.108	.009	.005
260.	2.4143	.9233	57.383392	.398	1.202	.002	.001
270.	2.2910	.9335	55.818832	.353	1.291	.003	.002
280.	2.1828	.9423	54.421316	.311	1.375	.004	.002
290.	2.0872	.9499	53.167737	.272	1.452	.005	.002
300.	2.0036	.9566	52.081575	.236	1.522	.006	.003
310.	1.9306	.9623	51.148566	.204	1.585	.006	.003
320.	1.8601	.9672	50.177598	.174	1.636	.016	.008
330.	1.8091	.9715	49.644219	.151	1.690	.008	.004
340.	1.7585	.9751	49.050034	.129	1.732	.010	.005
350.	1.7134	.9782	48.543722	.110	1.768	.011	.006
360.	1.6730	.9809	48.112505	.094	1.799	.013	.007
370.	1.6365	.9831	47.744932	.080	1.825	.015	.007
380.	1.6033	.9849	47.430550	.068	1.846	.017	.008
390.	1.5730	.9865	47.160514	.058	1.864	.019	.010
400.	1.5450	.9877	46.927135	.050	1.878	.022	.011
410.	1.5190	.9888	46.723844	.043	1.890	.024	.012
420.	1.4947	.9896	46.545138	.037	1.899	.027	.014
430.	1.4718	.9903	46.386396	.032	1.906	.031	.015
440.	1.4502	.9909	46.243561	.027	1.911	.034	.017
450.	1.4296	.9913	46.113570	.023	1.915	.038	.019
460.	1.4099	.9917	45.993498	.020	1.917	.042	.021
470.	1.3909	.9920	45.881063	.018	1.918	.046	.023
480.	1.3725	.9922	45.774371	.015	1.918	.051	.026
490.	1.3547	.9924	45.671747	.013	1.917	.056	.028
500.	1.3374	.9926	45.571819	.012	1.915	.062	.031

400.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.2784	.0717	91.959573	.999	.001	.000	.000
80.	89.5099	.0709	91.946459	.999	.002	.000	.000
90.	88.7286	.0703	91.927750	.999	.002	.000	.000
100.	87.9267	.0696	91.902561	.999	.002	.000	.000
110.	87.0986	.0690	91.870091	.998	.003	.000	.000
120.	86.2383	.0685	91.827313	.998	.004	.000	.000
130.	85.3473	.0680	91.778048	.997	.005	.000	.000
140.	84.4182	.0675	91.716123	.997	.006	.000	.000
150.	83.4484	.0671	91.639740	.996	.008	.000	.000
160.	82.4335	.0668	91.546402	.995	.010	.000	.000
170.	81.3683	.0665	91.432575	.994	.013	.000	.000
180.	80.2474	.0663	91.295426	.992	.015	.000	.000
190.	79.0606	.0661	91.129570	.990	.019	.000	.000
200.	77.7964	.0660	90.929665	.988	.023	.000	.000
210.	76.4391	.0660	90.688967	.986	.028	.000	.000
220.	74.9671	.0661	90.400473	.982	.035	.001	.000
230.	73.3489	.0664	90.053766	.979	.042	.001	.000
231.03	73.1714	.0655	90.014120	.978	.043	.001	.000
231.03	4.3025	.8084	65.285443	.591	.817	.001	.001
240.	4.0116	.8426	63.451130	.550	.898	.001	.001
250.	3.7346	.8648	61.492791	.504	.989	.002	.001
260.	3.4970	.8835	59.651542	.458	1.081	.002	.001
270.	3.2909	.8994	57.937854	.413	1.171	.003	.001
280.	3.1116	.9129	56.367769	.369	1.258	.003	.002
290.	2.9462	.9245	54.780838	.325	1.339	.010	.005
300.	2.8144	.9345	53.599506	.287	1.417	.008	.004
310.	2.6920	.9430	52.419036	.251	1.486	.012	.006
320.	2.5961	.9504	51.608445	.220	1.553	.006	.003
330.	2.5046	.9567	50.761780	.191	1.611	.007	.004
340.	2.4238	.9621	50.027837	.165	1.661	.009	.004
350.	2.3524	.9667	49.397797	.142	1.706	.010	.005
360.	2.2877	.9706	48.829532	.122	1.743	.013	.007
370.	2.2322	.9739	48.391323	.105	1.777	.013	.007
380.	2.1812	.9767	47.992653	.090	1.804	.015	.008
390.	2.1350	.9791	47.650239	.077	1.828	.017	.009
400.	2.0929	.9810	47.354650	.067	1.848	.019	.010
410.	2.0543	.9827	47.098602	.057	1.864	.022	.011
420.	2.0185	.9840	46.875306	.049	1.877	.024	.012
430.	1.9853	.9851	46.679011	.042	1.888	.027	.014
440.	1.9541	.9860	46.504896	.037	1.896	.031	.015
450.	1.9247	.9868	46.348720	.032	1.903	.034	.017
460.	1.8967	.9874	46.207225	.027	1.907	.038	.019
470.	1.8701	.9879	46.077312	.024	1.911	.042	.021
480.	1.8445	.9883	45.956533	.021	1.913	.046	.023
490.	1.8198	.9887	45.842831	.018	1.913	.051	.025
500.	1.7959	.9891	45.734407	.016	1.913	.055	.028

500.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.3392	.0896	91.966141	.999	.001	.000	.000
80.	89.5677	.0886	91.947124	.999	.001	.000	.000
90.	88.7899	.0878	91.928708	.999	.002	.000	.000
100.	87.9919	.0870	91.903882	.999	.002	.000	.000
110.	87.1681	.0862	91.871851	.998	.003	.000	.000
120.	86.3144	.0855	91.831583	.998	.004	.000	.000
130.	85.4267	.0849	91.780988	.997	.005	.000	.000
140.	84.5035	.0843	91.719959	.997	.006	.000	.000
150.	83.5403	.0838	91.644702	.996	.008	.000	.000
160.	82.5330	.0834	91.552803	.995	.010	.000	.000
170.	81.4766	.0830	91.440801	.994	.012	.000	.000
180.	80.3661	.0828	91.306038	.992	.015	.000	.000
190.	79.1918	.0825	91.143217	.991	.019	.000	.000
200.	77.9428	.0824	90.947209	.988	.023	.000	.000
210.	76.6043	.0824	90.711800	.986	.028	.000	.000
220.	75.1558	.0825	90.429360	.983	.034	.000	.000
230.	73.5689	.0827	90.090952	.979	.041	.001	.000
240.	71.8011	.0832	89.684918	.974	.050	.001	.000
244.72	70.8859	.0829	89.465795	.972	.055	.001	.000
244.72	5.4193	.7819	64.542994	.575	.849	.001	.001
250.	5.1718	.8060	63.491715	.551	.896	.001	.001
260.	4.7740	.8351	61.577203	.507	.985	.002	.001
270.	4.4444	.8588	59.773309	.462	1.075	.002	.001
280.	4.1654	.8785	58.093443	.417	1.163	.003	.001
290.	3.9265	.8951	56.550998	.375	1.248	.003	.002
300.	3.7208	.9092	55.157106	.334	1.329	.004	.002
310.	3.5424	.9212	53.904630	.295	1.405	.005	.002
320.	3.3873	.9314	52.792970	.260	1.475	.006	.003
330.	3.2523	.9401	51.818762	.228	1.538	.007	.003
340.	3.1338	.9476	50.963946	.198	1.596	.008	.004
350.	3.0298	.9539	50.222223	.172	1.646	.009	.004
360.	2.9379	.9593	49.580139	.149	1.691	.010	.005
370.	2.8564	.9639	49.025025	.129	1.730	.012	.006
380.	2.7837	.9677	48.547057	.111	1.763	.014	.007
390.	2.7184	.9710	48.134591	.096	1.792	.016	.008
400.	2.6594	.9737	47.778473	.083	1.816	.018	.009
410.	2.6057	.9760	47.470030	.072	1.837	.020	.010
420.	2.5565	.9779	47.201794	.062	1.854	.022	.011
430.	2.5111	.9795	46.967185	.053	1.868	.025	.013
440.	2.4690	.9808	46.760571	.046	1.880	.028	.014
450.	2.4296	.9819	46.577087	.040	1.889	.031	.016
460.	2.3924	.9829	46.412601	.035	1.896	.035	.017
470.	2.3572	.9836	46.263579	.030	1.901	.038	.019
480.	2.3236	.9843	46.127075	.026	1.905	.042	.021
490.	2.2915	.9849	46.000498	.023	1.908	.047	.023
500.	2.2605	.9855	45.881758	.020	1.909	.051	.026

600.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.3940	.1074	91.966690	.999	.001	.000	.000
80.	89.6254	.1063	91.947760	.999	.001	.000	.000
90.	88.8511	.1052	91.929619	.999	.002	.000	.000
100.	88.0569	.1043	91.905128	.999	.002	.000	.000
110.	87.2373	.1034	91.873504	.998	.003	.000	.000
120.	86.3881	.1025	91.833735	.998	.004	.000	.000
130.	85.5056	.1018	91.783707	.997	.005	.000	.000
140.	84.5882	.1011	91.723499	.997	.006	.000	.000
150.	83.6313	.1005	91.649246	.996	.008	.000	.000
160.	82.6313	.1000	91.558611	.995	.010	.000	.000
170.	81.5833	.0995	91.448191	.994	.012	.000	.000
180.	80.4827	.0992	91.315484	.992	.015	.000	.000
190.	79.3201	.0989	91.155254	.991	.019	.000	.000
200.	78.0853	.0987	90.962542	.989	.023	.000	.000
210.	76.7643	.0987	90.731327	.986	.028	.000	.000
220.	75.3381	.0988	90.454236	.983	.034	.000	.000
230.	73.7800	.0990	90.122654	.979	.041	.001	.000
240.	72.0513	.0995	89.725389	.975	.050	.001	.000
250.	70.0919	.1003	89.248998	.969	.060	.001	.000
256.21	68.7174	.1005	88.905961	.966	.068	.001	.001
256.21	6.6005	.7533	64.003228	.563	.872	.001	.001
260.	6.3524	.7738	63.271413	.546	.906	.002	.001
270.	5.8096	.8098	61.399275	.502	.993	.002	.001
280.	5.3776	.8383	59.638032	.458	1.081	.002	.001
290.	5.0213	.8615	57.999896	.415	1.167	.003	.001
300.	4.7216	.8807	56.499396	.373	1.250	.003	.002
310.	4.4662	.8968	55.136989	.333	1.329	.004	.002
320.	4.2466	.9104	53.913028	.296	1.403	.005	.003
330.	4.0569	.9219	52.825011	.261	1.472	.006	.003
340.	3.8918	.9317	51.861011	.229	1.534	.007	.004
350.	3.7481	.9400	51.022976	.201	1.590	.008	.004
360.	3.6218	.9471	50.287509	.175	1.641	.010	.005
370.	3.5106	.9531	49.649260	.152	1.685	.011	.005
380.	3.4119	.9582	49.095424	.132	1.723	.013	.006
390.	3.3239	.9625	48.615840	.114	1.757	.014	.007
400.	3.2451	.9661	48.200620	.099	1.785	.016	.008
410.	3.1738	.9691	47.840633	.086	1.810	.018	.009
420.	3.1091	.9716	47.527610	.074	1.831	.021	.010
430.	3.0498	.9737	47.254438	.064	1.848	.023	.012
440.	2.9952	.9755	47.014789	.056	1.862	.026	.013
450.	2.9444	.9770	46.803114	.048	1.874	.029	.015
460.	2.8969	.9783	46.614730	.042	1.884	.032	.016
470.	2.8523	.9793	46.445576	.037	1.891	.036	.018
480.	2.8099	.9803	46.292180	.032	1.897	.039	.020
490.	2.7695	.9811	46.151590	.028	1.901	.043	.022
500.	2.7308	.9819	46.021290	.024	1.903	.048	.024

700.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.4487	.1252	91.967224	.999	.001	.000	.000
80.	89.6865	.1239	91.951889	.999	.001	.000	.000
90.	88.9121	.1227	91.930498	.999	.002	.000	.000
100.	88.1216	.1216	91.906324	.999	.002	.000	.000
110.	87.3061	.1205	91.875083	.998	.003	.000	.000
120.	86.4615	.1195	91.835786	.998	.004	.000	.000
130.	85.5839	.1186	91.786276	.998	.005	.000	.000
140.	84.6722	.1178	91.726839	.997	.006	.000	.000
150.	83.7215	.1171	91.653518	.996	.008	.000	.000
160.	82.7285	.1165	91.564041	.995	.010	.000	.000
170.	81.6893	.1160	91.455478	.994	.012	.000	.000
180.	80.5976	.1155	91.324203	.992	.015	.000	.000
190.	79.4462	.1152	91.166293	.991	.018	.000	.000
200.	78.2250	.1150	90.976510	.989	.022	.000	.000
210.	76.9206	.1149	90.749004	.986	.027	.000	.000
220.	75.5152	.1150	90.476613	.983	.033	.000	.000
230.	73.9842	.1153	90.151009	.980	.040	.000	.000
240.	72.2917	.1158	89.761390	.975	.049	.001	.000
250.	70.3836	.1166	89.294729	.970	.059	.001	.000
260.	68.1695	.1180	88.734593	.964	.072	.001	.001
266.13	66.5920	.1186	88.335748	.959	.081	.001	.001
266.13	7.8662	.7229	63.611508	.554	.890	.002	.001
270.	7.5210	.7474	62.879822	.537	.923	.002	.001
280.	6.8161	.7900	61.055220	.494	1.010	.002	.001
290.	6.2778	.8225	59.340051	.451	1.096	.003	.001
300.	5.8447	.8485	57.752416	.408	1.180	.003	.002
310.	5.4856	.8698	56.295357	.367	1.261	.004	.002
320.	5.1830	.8874	54.976261	.329	1.338	.005	.002
330.	4.9246	.9022	53.788071	.292	1.410	.006	.003
340.	4.7027	.9147	52.734356	.258	1.477	.006	.003
350.	4.5105	.9253	51.801955	.227	1.537	.008	.004
360.	4.3429	.9342	50.980968	.200	1.592	.009	.004
370.	4.1963	.9418	50.264145	.174	1.641	.010	.005
380.	4.0671	.9482	49.638721	.152	1.684	.012	.006
390.	3.9527	.9536	49.095089	.132	1.722	.013	.007
400.	3.8507	.9581	48.622556	.115	1.754	.015	.008
410.	3.7592	.9620	48.211860	.100	1.783	.017	.009
420.	3.6766	.9652	47.854465	.087	1.807	.019	.010
430.	3.6015	.9679	47.542667	.075	1.827	.022	.011
440.	3.5327	.9702	47.269569	.066	1.844	.024	.012
450.	3.4692	.9721	47.029100	.057	1.859	.027	.014
460.	3.4102	.9737	46.816170	.050	1.870	.030	.015
470.	3.3551	.9751	46.626038	.043	1.880	.034	.017
480.	3.3031	.9763	46.454953	.038	1.887	.037	.019
490.	3.2538	.9774	46.299460	.033	1.893	.041	.020
500.	3.2067	.9784	46.156707	.029	1.897	.045	.022

800.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.5034	.1430	91.967746	.999	.001	.000	.000
80.	89.7441	.1415	91.952590	.999	.001	.000	.000
90.	88.9729	.1401	91.931352	.999	.002	.000	.000
100.	88.1862	.1388	91.907482	.999	.002	.000	.000
110.	87.3747	.1376	91.876606	.998	.003	.000	.000
120.	86.5346	.1365	91.837758	.998	.004	.000	.000
130.	85.6618	.1355	91.788723	.998	.005	.000	.000
140.	84.7555	.1345	91.730028	.997	.006	.000	.000
150.	83.8109	.1337	91.657592	.996	.008	.000	.000
160.	82.8249	.1330	91.569202	.995	.010	.000	.000
170.	81.7935	.1324	91.461996	.994	.012	.000	.000
180.	80.7110	.1319	91.332415	.993	.015	.000	.000
190.	79.5704	.1315	91.176642	.991	.018	.000	.000
200.	78.3622	.1312	90.989544	.989	.022	.000	.000
210.	77.0737	.1311	90.765418	.986	.027	.000	.000
220.	75.6881	.1311	90.497292	.983	.033	.000	.000
230.	74.1825	.1314	90.177093	.980	.040	.000	.000
240.	72.5238	.1319	89.794364	.976	.048	.001	.000
250.	70.6630	.1328	89.336547	.970	.059	.001	.000
260.	68.5204	.1342	88.787830	.964	.071	.001	.000
270.	65.9486	.1365	88.127519	.956	.086	.001	.001
274.89	64.4482	.1372	87.756107	.952	.094	.001	.001
274.89	9.2948	.6906	63.689068	.552	.902	.000	.000
280.	8.6349	.7281	62.381150	.526	.946	.002	.001
290.	7.7670	.7759	60.603146	.483	1.032	.002	.001
300.	7.1277	.8115	58.939355	.440	1.117	.003	.001
310.	6.6230	.8395	57.401294	.399	1.199	.004	.002
320.	6.2098	.8622	55.994392	.359	1.278	.004	.002
330.	5.8645	.8809	54.721468	.321	1.353	.005	.003
340.	5.5715	.8965	53.578418	.286	1.423	.006	.003
350.	5.3199	.9096	52.554493	.253	1.487	.007	.004
360.	5.1018	.9206	51.640939	.223	1.545	.009	.005
370.	4.9157	.9299	50.872860	.196	1.598	.010	.005
380.	4.7507	.9378	50.178973	.172	1.646	.011	.005
390.	4.6056	.9444	49.573271	.150	1.687	.013	.006
400.	4.4769	.9500	49.044904	.131	1.724	.014	.007
410.	4.3623	.9547	48.584481	.114	1.755	.016	.008
420.	4.2593	.9587	48.183139	.099	1.783	.018	.009
430.	4.1663	.9620	47.832739	.087	1.806	.021	.010
440.	4.0816	.9649	47.525991	.075	1.826	.023	.012
450.	4.0039	.9672	47.256451	.066	1.843	.026	.013
460.	3.9322	.9693	47.018327	.057	1.857	.029	.014
470.	3.8655	.9710	46.806671	.050	1.868	.032	.016
480.	3.8030	.9725	46.617155	.044	1.877	.035	.018
490.	3.7440	.9738	46.446019	.038	1.885	.039	.019
500.	3.6879	.9751	46.290122	.034	1.890	.043	.021

900.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.5580	.1608	91.968255	.999	.001	.000	.000
80.	89.8016	.1591	91.953276	.999	.001	.000	.000
90.	89.0336	.1575	91.932185	.999	.002	.000	.000
100.	88.2505	.1561	91.908610	.999	.002	.000	.000
110.	87.4430	.1547	91.878085	.999	.003	.000	.000
120.	86.6073	.1534	91.839667	.998	.004	.000	.000
130.	85.7400	.1523	91.792001	.998	.005	.000	.000
140.	84.8383	.1512	91.733097	.997	.006	.000	.000
150.	83.8997	.1503	91.661509	.996	.008	.000	.000
160.	82.9205	.1495	91.574155	.995	.010	.000	.000
170.	81.8967	.1488	91.468233	.994	.012	.000	.000
180.	80.8230	.1482	91.340243	.993	.015	.000	.000
190.	79.6930	.1477	91.186443	.991	.018	.000	.000
200.	78.4972	.1474	91.001883	.989	.022	.000	.000
210.	77.2239	.1472	90.780900	.986	.027	.000	.000
220.	75.8572	.1472	90.516721	.984	.033	.000	.000
230.	74.3757	.1475	90.201514	.980	.040	.000	.000
240.	72.7487	.1480	89.825125	.976	.048	.000	.000
250.	70.9318	.1489	89.375421	.971	.058	.001	.000
260.	68.8541	.1504	88.837154	.965	.070	.001	.000
270.	66.3896	.1527	88.190581	.957	.085	.001	.001
280.	63.2688	.1566	87.409679	.948	.103	.001	.001
282.74	62.2214	.1567	87.167697	.945	.108	.002	.001
282.74	10.7645	.6561	63.132215	.543	.911	.002	.001
290.	9.6459	.7169	61.808940	.512	.973	.002	.001
300.	8.6382	.7678	60.077782	.470	1.058	.003	.001
310.	7.9127	.8051	58.465552	.428	1.141	.003	.002
320.	7.3473	.8342	56.982035	.387	1.222	.004	.002
330.	6.8832	.8577	55.587784	.348	1.298	.006	.003
340.	6.5065	.8770	54.406500	.312	1.371	.006	.003
350.	6.1806	.8930	53.282140	.277	1.438	.008	.004
360.	5.9069	.9063	52.323490	.246	1.501	.008	.004
370.	5.6708	.9176	51.475127	.217	1.557	.009	.005
380.	5.4644	.9270	50.716649	.191	1.608	.010	.005
390.	5.2837	.9350	50.050940	.167	1.653	.012	.006
400.	5.1246	.9417	49.468282	.147	1.693	.014	.007
410.	4.9836	.9474	48.959014	.128	1.728	.015	.008
420.	4.8576	.9522	48.514107	.112	1.759	.017	.009
430.	4.7445	.9562	48.125322	.098	1.785	.020	.010
440.	4.6420	.9596	47.784820	.085	1.807	.022	.011
450.	4.5486	.9625	47.485776	.074	1.827	.024	.012
460.	4.4629	.9649	47.222078	.065	1.843	.027	.014
470.	4.3835	.9670	46.988338	.057	1.856	.030	.015
480.	4.3095	.9689	46.779817	.050	1.867	.033	.017
490.	4.2399	.9705	46.592523	.044	1.876	.037	.018
500.	4.1742	.9719	46.422822	.038	1.883	.041	.020

1000.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	90.6126	.1786	91.968753	.999	.001	.000	.000
80.	89.8590	.1767	91.953947	.999	.001	.000	.000
90.	89.0942	.1749	91.932998	.999	.002	.000	.000
100.	88.3146	.1733	91.909711	.999	.002	.000	.000
110.	87.5111	.1717	91.879526	.999	.003	.000	.000
120.	86.6796	.1703	91.841522	.998	.004	.000	.000
130.	85.8171	.1690	91.794373	.998	.005	.000	.000
140.	84.9205	.1679	91.736067	.997	.006	.000	.000
150.	83.9878	.1668	91.665294	.996	.008	.000	.000
160.	83.0151	.1659	91.578937	.995	.009	.000	.000
170.	81.9989	.1651	91.474242	.994	.012	.000	.000
180.	80.9339	.1644	91.347760	.993	.015	.000	.000
190.	79.8139	.1639	91.195872	.991	.018	.000	.000
200.	78.6303	.1635	91.013677	.989	.022	.000	.000
210.	77.3716	.1633	90.795652	.987	.027	.000	.000
220.	76.0229	.1633	90.535178	.984	.032	.000	.000
230.	74.5642	.1635	90.224643	.980	.039	.000	.000
240.	72.9672	.1640	89.854170	.976	.047	.000	.000
250.	71.1911	.1649	89.412013	.971	.057	.001	.000
260.	69.1727	.1664	88.883507	.965	.069	.001	.000
270.	66.8032	.1687	88.249577	.958	.083	.001	.000
280.	63.8635	.1726	87.485558	.949	.101	.001	.001
289.86	59.8293	.1799	86.571578	.938	.122	.002	.001
289.86	12.4826	.6274	63.005737	.541	.917	.002	.001
290.	12.4392	.6293	62.970103	.540	.918	.002	.001
300.	10.5174	.7137	61.188865	.497	1.003	.003	.001
310.	9.4143	.7653	59.505523	.455	1.087	.003	.002
320.	8.6251	.8030	57.947265	.414	1.168	.004	.002
330.	8.0128	.8324	56.518211	.374	1.247	.004	.002
340.	7.5176	.8560	55.219703	.336	1.322	.005	.003
350.	7.1070	.8753	54.050919	.301	1.392	.006	.003
360.	6.7603	.8913	53.002773	.268	1.457	.007	.004
370.	6.4645	.9047	52.072091	.237	1.517	.009	.004
380.	6.2101	.9159	51.253383	.210	1.571	.010	.005
390.	5.9886	.9254	50.529179	.185	1.620	.011	.006
400.	5.7947	.9333	49.893240	.162	1.663	.013	.006
410.	5.6238	.9400	49.335713	.142	1.701	.015	.007
420.	5.4720	.9457	48.847947	.125	1.734	.017	.008
430.	5.3363	.9504	48.420699	.109	1.763	.019	.009
440.	5.2142	.9544	48.046390	.095	1.789	.021	.010
450.	5.1034	.9578	47.717618	.083	1.810	.023	.012
460.	5.0021	.9607	47.427968	.073	1.828	.026	.013
470.	4.9089	.9632	47.171690	.064	1.844	.029	.014
480.	4.8224	.9654	46.943740	.056	1.856	.032	.016
490.	4.7415	.9673	46.739680	.049	1.867	.035	.018
500.	4.6653	.9690	46.555661	.043	1.875	.039	.019

2000.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	91.1575	.3550	91.973191	1.000	.001	.000	.000
80.	90.4294	.3512	91.959974	.999	.001	.000	.000
90.	89.6956	.3476	91.942625	.999	.002	.000	.000
100.	88.9476	.3441	91.920524	.999	.002	.000	.000
110.	88.1792	.3409	91.892423	.999	.003	.000	.000
120.	87.3871	.3380	91.858050	.998	.003	.000	.000
130.	86.5677	.3352	91.815360	.998	.004	.000	.000
140.	85.7188	.3327	91.762864	.997	.005	.000	.000
150.	84.8382	.3304	91.698406	.997	.007	.000	.000
160.	83.9243	.3283	91.620549	.996	.009	.000	.000
170.	82.9744	.3265	91.526304	.995	.011	.000	.000
180.	81.9852	.3249	91.412776	.993	.013	.000	.000
190.	80.9525	.3235	91.276303	.992	.016	.000	.000
200.	79.8713	.3223	91.113633	.990	.020	.000	.000
210.	78.7345	.3214	90.919719	.988	.024	.000	.000
220.	77.5331	.3207	90.689124	.985	.029	.000	.000
230.	76.2556	.3204	90.415408	.982	.035	.000	.000
240.	74.8875	.3205	90.091316	.979	.042	.000	.000
250.	73.4095	.3209	89.707591	.974	.051	.000	.000
260.	71.7955	.3219	89.253129	.969	.061	.000	.000
270.	70.0096	.3237	88.714401	.963	.073	.000	.000
280.	67.9995	.3264	88.074838	.956	.088	.001	.000
290.	65.6824	.3305	87.312471	.947	.106	.001	.000
300.	62.9162	.3369	86.399495	.936	.128	.001	.001
310.	59.4177	.3476	85.297472	.922	.155	.001	.001
320.	54.5187	.3681	83.951998	.905	.189	.002	.001
330.	46.6894	.4159	82.280022	.883	.232	.002	.001
340.	35.8238	.5214	80.139592	.853	.291	.003	.001
350.	28.3445	.6271	77.225142	.810	.376	.004	.002
360.	19.8177	.6968	60.730517	.487	1.021	.005	.002
370.	17.6468	.7469	58.674400	.435	1.125	.006	.003
380.	16.1202	.7854	57.039570	.390	1.213	.007	.003
390.	14.9578	.8160	55.644532	.350	1.292	.008	.004
400.	14.0331	.8409	54.429188	.314	1.363	.009	.004
410.	13.2766	.8614	53.363220	.281	1.428	.010	.005
420.	12.6443	.8784	52.422459	.251	1.487	.012	.006
430.	12.1087	.8926	51.596569	.223	1.540	.013	.007
440.	11.6484	.9046	50.866998	.198	1.588	.015	.007
450.	11.2484	.9148	50.222981	.176	1.631	.017	.008
460.	10.8977	.9234	49.654478	.156	1.669	.019	.009
470.	10.5872	.9307	49.152378	.138	1.702	.021	.010
480.	10.3099	.9370	48.708342	.122	1.732	.023	.012
490.	10.0602	.9425	48.315039	.108	1.758	.026	.013
500.	9.8333	.9473	47.965896	.096	1.780	.028	.014

3000.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	91.7040	.5294	91.976815	1.000	.001	.000	.000
80.	90.9966	.5235	91.964982	.999	.001	.000	.000
90.	90.2874	.5180	91.949244	.999	.001	.000	.000
100.	89.5672	.5127	91.929076	.999	.002	.000	.000
110.	88.8293	.5077	91.903199	.999	.002	.000	.000
120.	88.0710	.5031	91.871892	.998	.003	.000	.000
130.	87.2883	.4988	91.832882	.998	.004	.000	.000
140.	86.4796	.4948	91.784893	.997	.005	.000	.000
150.	85.6428	.4911	91.725826	.997	.006	.000	.000
160.	84.7776	.4877	91.654805	.996	.008	.000	.000
170.	83.8819	.4847	91.568878	.995	.010	.000	.000
180.	82.9536	.4819	91.465535	.994	.012	.000	.000
190.	81.9901	.4794	91.341774	.993	.015	.000	.000
200.	80.9874	.4772	91.193676	.991	.018	.000	.000
210.	79.9420	.4753	91.018269	.989	.022	.000	.000
220.	78.8476	.4737	90.810344	.987	.026	.000	.000
230.	77.6969	.4725	90.564408	.984	.032	.000	.000
240.	76.4807	.4716	90.273850	.981	.038	.000	.000
250.	75.1885	.4712	89.932102	.977	.046	.000	.000
260.	73.8062	.4712	89.529826	.972	.055	.000	.000
270.	72.3159	.4718	89.056365	.967	.066	.000	.000
280.	70.6951	.4731	88.498856	.960	.079	.000	.000
290.	68.9147	.4753	87.842358	.953	.094	.001	.000
300.	66.9342	.4787	87.066821	.944	.112	.001	.000
310.	64.6979	.4836	86.148092	.932	.134	.001	.000
320.	62.1239	.4909	85.054345	.919	.161	.001	.001
330.	59.0885	.5017	83.742824	.902	.195	.001	.001
340.	55.4137	.5183	82.158978	.881	.236	.002	.001
350.	50.9061	.5441	80.218080	.854	.290	.002	.001
360.	45.6396	.5814	77.797671	.819	.360	.003	.001
370.	40.1455	.6269	74.696169	.770	.456	.004	.002
380.	34.8417	.6744	70.570157	.698	.599	.005	.002
390.	29.8967	.7188	65.311347	.594	.806	.006	.003
400.	26.2821	.7579	61.251683	.501	.991	.007	.003
410.	23.8701	.7913	58.758753	.438	1.116	.008	.004
420.	22.0771	.8195	56.931768	.388	1.214	.009	.005
430.	20.6645	.8434	55.461051	.346	1.297	.010	.005
440.	19.5143	.8635	54.226728	.309	1.370	.012	.006
450.	18.5566	.8805	53.168625	.276	1.435	.013	.007
460.	17.7446	.8950	52.247931	.246	1.492	.015	.008
470.	17.0496	.9074	51.450033	.220	1.543	.017	.008
480.	16.4448	.9181	50.746633	.196	1.589	.019	.009
490.	15.9139	.9273	50.127157	.175	1.630	.021	.010
500.	15.4431	.9352	49.580047	.156	1.666	.023	.012

4000.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	92.2599	.7016	91.981202	1.000	.001	.000	.000
80.	91.5663	.6937	91.969191	.999	.001	.000	.000
90.	90.8767	.6862	91.954869	.999	.001	.000	.000
100.	90.1796	.6790	91.936376	.999	.002	.000	.000
110.	89.4681	.6722	91.913052	.999	.002	.000	.000
120.	88.7378	.6658	91.883700	.999	.003	.000	.000
130.	87.9864	.6599	91.847855	.998	.004	.000	.000
140.	87.2117	.6543	91.803701	.998	.005	.000	.000
150.	86.4126	.6492	91.749784	.997	.006	.000	.000
160.	85.5878	.6444	91.683962	.996	.007	.000	.000
170.	84.7372	.6400	91.605004	.996	.009	.000	.000
180.	83.8589	.6359	91.510120	.994	.011	.000	.000
190.	82.9514	.6322	91.396643	.993	.014	.000	.000
200.	82.0117	.6288	91.260791	.992	.016	.000	.000
210.	81.0380	.6257	91.100481	.990	.020	.000	.000
220.	80.0257	.6230	90.910820	.988	.024	.000	.000
230.	78.9699	.6207	90.687147	.985	.029	.000	.000
240.	77.8638	.6187	90.423037	.982	.035	.000	.000
250.	76.7018	.6171	90.114238	.979	.042	.000	.000
260.	75.4741	.6159	89.752103	.975	.050	.000	.000
270.	74.1702	.6152	89.328071	.970	.060	.000	.000
280.	99.2674	.4510	88.831734	.964	.071	.000	.000
290.	71.2790	.6156	88.250582	.958	.085	.000	.000
300.	69.6582	.6168	87.571099	.950	.100	.001	.000
310.	67.8902	.6190	86.774437	.940	.119	.001	.000
320.	65.9457	.6223	85.838471	.928	.142	.001	.000
330.	63.7893	.6270	84.737558	.915	.170	.001	.001
340.	94.3676	.4121	83.437036	.898	.203	.001	.001
350.	58.6459	.6429	81.894578	.877	.244	.002	.001
360.	55.5438	.6555	80.057915	.852	.294	.002	.001
370.	52.0251	.6724	77.864936	.820	.358	.003	.001
380.	48.1139	.6943	75.252572	.779	.439	.003	.002
390.	43.9609	.7204	72.194108	.728	.541	.004	.002
400.	39.8421	.7487	68.799752	.665	.665	.005	.003
410.	36.0923	.7770	65.426428	.597	.800	.006	.003
420.	32.9455	.8037	62.484567	.531	.931	.007	.004
430.	30.4017	.8281	60.090191	.473	1.046	.009	.004
440.	28.3398	.8501	58.146730	.422	1.145	.010	.005
450.	26.6423	.8696	56.537952	.378	1.233	.011	.006
460.	25.2227	.8867	55.180264	.339	1.310	.013	.006
470.	24.0190	.9017	54.017009	.304	1.379	.014	.007
480.	22.9862	.9148	53.009948	.272	1.440	.016	.008
490.	22.0909	.9263	52.131800	.244	1.495	.018	.009
500.	21.3070	.9363	51.361306	.218	1.544	.020	.010

5000.0 PSIA Isobar

Temp F	Density lb/cu ft	Z	Molecular mass	Composition N2O4	NO2	NO	O2
70.	92.8313	.8716	91.984055	1.000	.001	.000	.000
80.	92.1454	.8617	91.972757	1.000	.001	.000	.000
90.	91.4699	.8522	91.959695	.999	.001	.000	.000
100.	90.7907	.8431	91.942676	.999	.002	.000	.000
110.	90.1004	.8344	91.921134	.999	.002	.000	.000
120.	89.3937	.8263	91.893881	.999	.003	.000	.000
130.	88.6686	.8186	91.860807	.998	.003	.000	.000
140.	87.9227	.8114	91.819978	.998	.004	.000	.000
150.	87.1550	.8047	91.770102	.997	.005	.000	.000
160.	86.3646	.7984	91.709134	.997	.007	.000	.000
170.	85.5518	.7926	91.636177	.996	.008	.000	.000
180.	84.7152	.7872	91.548506	.995	.010	.000	.000
190.	83.8540	.7821	91.443745	.994	.012	.000	.000
200.	82.9665	.7774	91.319096	.992	.015	.000	.000
210.	82.0500	.7731	91.170635	.991	.018	.000	.000
220.	81.1031	.7692	90.996225	.989	.022	.000	.000
230.	80.1215	.7656	90.790924	.987	.027	.000	.000
240.	79.1008	.7623	90.549832	.984	.032	.000	.000
250.	78.0350	.7595	90.266476	.981	.039	.000	.000
260.	76.9199	.7570	89.936700	.977	.046	.000	.000
270.	75.7469	.7549	89.551867	.973	.055	.000	.000
280.	74.5076	.7533	89.103252	.967	.065	.000	.000
290.	73.1910	.7522	88.579851	.961	.077	.000	.000
300.	71.7875	.7516	87.972295	.954	.091	.000	.000
310.	70.2822	.7516	87.265151	.946	.108	.001	.000
320.	68.6589	.7524	86.441519	.936	.128	.001	.000
330.	66.8985	.7539	85.481107	.924	.151	.001	.000
340.	64.9808	.7564	84.362354	.910	.179	.001	.001
350.	62.8804	.7601	83.056103	.893	.213	.001	.001
360.	60.5704	.7651	81.530183	.872	.254	.002	.001
370.	90.6656	.4940	79.749696	.847	.303	.002	.001
380.	55.2264	.7805	77.682334	.817	.364	.003	.001
390.	52.1768	.7915	75.309697	.780	.437	.003	.002
400.	48.9248	.8049	72.655565	.736	.525	.004	.002
410.	45.5863	.8205	69.816249	.684	.626	.005	.002
420.	42.3382	.8378	66.970209	.629	.736	.006	.003
430.	39.3518	.8559	64.309987	.573	.848	.007	.003
440.	36.7196	.8737	61.950081	.519	.954	.008	.004
450.	34.4498	.8908	59.910602	.469	1.053	.009	.005
460.	32.5047	.9065	58.159485	.423	1.143	.011	.005
470.	30.8348	.9208	56.652067	.382	1.224	.012	.006
480.	29.3932	.9337	55.346866	.344	1.298	.014	.007
490.	28.1402	.9452	54.210011	.310	1.364	.015	.008
500.	27.0434	.9554	53.214484	.279	1.424	.017	.009

Appendix C.

Table C1. Computer Program Listings

```
      PROGRAM MAIN (INPUT,OUTPUT)
      REAL KP1,KP2
      DIMENSION Y(4),A(4),PP(23)
      COMMON/SOLVE/KP1,KP2,Y,WMA,A
      COMMON/COMPRP1/NC1,ND1,PC1(5),TC1(5),W1(5),OMK1(10)
      COMMON/TEMP/YID(4)
      DATA(PP=1.01325,2.,4.,6.,8.,10.,15.,20.,30.,40.,50.,60.,80.,100.
     1,120.,140.,160.,180.,200.,250.,300.,350.,400.)
      CALL DATAO4
      DO 20 I=1,23,22
      R=.0831434
      IND=0
      DCAL=16.
      P=PP(I)
      POUT=P/10.
      PRINT 103,POUT
  103 FORMAT(*                        *,F5.1,* MPA ISOBAR*)
      IF(P.GT.100.)GO TO 2
      TS=FINDTV(P)
    2 CONTINUE
      IF(P.GT.100)TS=600.
      DO 20 J=295,550,5
      T=J
      IF(TS.GT.500)GO TO 10
      IF(T.GT.TS.AND.IND.EQ.0)GO TO 5
      GO TO 10
    5 IND=1
      D=DCAL
      L=5
      P=P+.001
      DCAL=FIND D(P,TS,D)
      P=PP(I)
      Z=P/(R*DCAL*T)
      PM=P/10.
      CALL MIXTURE(TS,PM,L)
      DD=DCAL*WMA
      IF(Y(3).LT.0)Y(3)=.00001
      IF(Y(4).LT.0)Y(4)=.00001
      PRINT 101,TS,DCAL,DD,Z,WMA,Y(1),Y(2),Y(3),Y(4)
      D=SATV(TS)
      D=D-.02*D
      DCAL=FIND D(P,TS,D)
      Z=P/(R*DCAL*T)
      L=3
      PM=P/10.
      CALL MIXTURE(TS,PM,L)
      DD=DCAL*WMA
      IF(Y(3).LT.0)Y(3)=.00001
      IF(Y(4).LT.0)Y(4)=.00001
      PRINT 101,TS,DCAL,DD,Z,WMA,Y(1),Y(2),Y(3),Y(4)
   10 DCAL=FIND D(P,T,D)
      Z=P/(R*DCAL*T)
      L=5
      IF(T.GT.TS.AND.IND.EQ.1)L=1
      PM=P/10.
```

```
      CALL MIXTURE(T,PM,L)
      DD=DCAL*WMA
      IF(Y(3).LT.0.0)Y(3)=.00001
      IF(Y(4).LT.0.0)Y(4)=.00001
      PRINT 100,T,DCAL,DD,Z,WMA,Y(1),Y(2),Y(3),Y(4)
  100 FORMAT(F6.0,2X,F10.4,F12.4,F8.4,F12.6,4F6.3)
  101 FORMAT(F8.2,F10.4,F12.4,F8.4,F12.6,4F6.3)
   20 CONTINUE
   22 CONTINUE
      STOP
      END
      PROGRAM MAIN (INPUT,OUTPUT)
      REAL KP1,KP2
      DIMENSION Y(4),A(4),PP(23)
      COMMON/SOLVE/KP1,KP2,Y,WMA,A
      COMMON/COMPRP1/NC1,ND1,PC1(5),TC1(5),W1(5),OMK1(10)
      COMMON/TEMP/YID(4)
      DATA(PP=14.696,20.,30.,40.,50.,60.,80.,100.,150.,200.,250.,300.,
     1400.,500.,600.,700.,800.,900.,1000.,2000.,3000.,4000.,5000.)
      CALL DATAO4
      DO 20 I=1,23
      R=.0831434
      IND=0
      DCAL=16.
      P=PP(I)*1.01325/14.696
      POUT=PP(I)
      PRINT 103,POUT
  103 FORMAT(*                        *,F5.1,* PSIA ISOBAR*)
      IF(P.GT.100.)GO TO 2
      TS=FINDTV(P)
    2 CONTINUE
      IF(P.GT.100)TS=600.
      DO 20 J=70,500,10
      TF=J
      T=(TF-32.)/1.8+273.15
      IF(TS.GT.500)GO TO 10
      IF(T.GT.TS.AND.IND.EQ.0)GO TO 5
      GO TO 10
    5 IND=1
      D=DCAL
      L=5
      P=P+.001
      DCAL=FIND D(P,TS,D)
      P=PP(I)*1.01325/14.696
      Z=P/(R*DCAL*T)
      PM=P/10.
      CALL MIXTURE(TS,PM,L)
      DD=DCAL*WMA/16.018
      IF(Y(3).LT.0)Y(3)=.00001
      IF(Y(4).LT.0)Y(4)=.00001
      TO=(TS-273.15)*1.8+32.
      PRINT 101,TO,DD,Z,WMA,Y(1),Y(2),Y(3),Y(4)
      D=SATV(TS)
      D=D-.02*D
      DCAL=FIND D(P,TS,D)
```

```
      Z=P/(R*DCAL*T)
      L=3
      PM=P/10.
      CALL MIXTURE(TS,PM,L)
      DD=DCAL*WMA/16.018
      IF(Y(3).LT.0)Y(3)=.00001
      IF(Y(4).LT.0)Y(4)=.00001
      PRINT 101,TO,DD,Z,WMA,Y(1),Y(2),Y(3),Y(4)
   10 DCAL=FIND D(P,T,D)
      Z=P/(R*DCAL*T)
      L=5
      IF(T.GT.TS.AND.IND.EQ.1)L=1
      PM=P/10.
      CALL MIXTURE(T,PM,L)
      DD=DCAL*WMA/16.018
      IF(Y(3).LT.0.0)Y(3)=.00001
      IF(Y(4).LT.0.0)Y(4)=.00001
      TO=(T-273.15)*1.8+32.
      PRINT 100,TO,DD,Z,WMA,Y(1),Y(2),Y(3),Y(4)
  100 FORMAT(F6.0,2X,F10.4,F8.4,F12.6,4F7.3)
  101 FORMAT(F8.2,F10.4,F8.4,F12.6,4F7.3)
   20 CONTINUE
   22 CONTINUE
      STOP
      END
      SUBROUTINE MIXTURE (T,P,L)
      COMMON /PHASED/ FOXP(5,2)
      COMMON/COMPRP1/NC1,ND1,PC1(5),TC1(5),W1(5),OMK1(10)
      COMMON/COMPRP2/NC2,ND2,PC2(5),TC2(5),W2(5),OMK2(10)
      COMMON/TEMP/YID(4)
      REAL IDKP1,IDKP2,KP1,KP2
      INTEGER Q
      DIMENSION Y(4),A(4),FU(5),Z1(2),X1(5,2),FUXP(5,2),Z2(2),X2(5,2)
      COMMON/SOLVE/KP1,KP2,Y,WMA,A
      COMMON /IDGAS/ ICALL,IDKP1,IDKP2
  108 FORMAT (5I5)
  109 FORMAT (4F20.10)
      Q=2
      IF(L.EQ.5 .OR. L.EQ.7) Q=1
C
C   INITIALIZING KPRS-ROUTINE
C
      DO 10 I=1,5
      PC1(I)=1.
      TC1(I)=1.
      W1(I)=1.
      OMK1(I)=1.
      OMK1(I+5) = 1.
      X1(I,1)=1.
      X1(I,2)=1.
      PC2(I)=1.
      TC2(I)=1.
      W2(I)=1.
      OMK2(I)=1.
```

```
      OMK2(I+5)=1.
      X2(I,1)=1.
      X2(I,2)=1.
   10 CONTINUE
      Z1(1)=1.
      Z1(2)=1.
      NC1=2
      ND1=1
      Z2(1)=1.
      Z2(2)=1.
      NC2=3
      ND2=1.
      ZAEHLER =1.
C   PROPERTIES NO2
      TC2(1)=239.303631
      PC2(1)=10.325
      W2(1)=0.0141345
      TC1(2)=239.303631
      PC1(2)=10.1325
      W1(2)=0.0141345
C   PROPERITES N204
      TC1(1)=547.4567
      PC1(1)=22.0951
      W1(1)=0.0141345
C   PROPERTIES NO
      TC2(2)=180.15
      PC2(2)=6.4848
      W2(2)= 0.0313
C   PROPERTIES O2
      TC2(3)=154.75
      PC2(3)=5.0764
      W2(3)=0.0998
C
C
      LAP1=0
      LAP2=0
      CALL KPRS1(P,Z1,T,X1,LAP1)
      CALL KPRS2(P,Z2,T,X2,LAP2)
C
C   CALCULATING IDEAL GAS EQUILIBRIUM
C
      ICALL = 0
      CALL IDGAS(T,P)
C
C   SOLVING FOR COMPOSITION
C
      KP1=IDKP1
      KP2=IDKP2
      CALL SOLVE(P)
      DO 70 I=1,4
   70 YID(I)=Y(I)
C
C   STORING COMPOSITION
C
```

```
   50 DO 20 I=1 ,4
   20 A(I)=Y(I)
C
C   CALCULATING FUGACITY COEFICIENTS
C
      LAP1=2
      LAP2=2
      X1(1,1)=A(1)
      X1(2,1)=A(2)
      X2(1,1)=A(2)
      X2(2,1)=A(3)
      X2(3,1)=A(4)
      X1(1,2)=A(1)
      X1(2,2)=A(2)
      X2(1,2)=A(2)
      X2(2,2)=A(3)
      X2(3,2)=A(4)
      CALL KPRS1(P,Z1,T,X1,LAP1)
      FU(1)=FOXP(1,Q)
      FU(2)=FOXP(2,Q)
      CALL KPRS2(P,Z2,T,X2,LAP2)
      FU(3)=FOXP(2,Q)
      FU(4)=FOXP(3,Q)
      FU(2)= (FU(2) + FOXP(1,Q))/2.
C
C   CHANGING KP
C
  530 KP1=IDKP1*FU(1)/FU(2)/FU(2)
      KP2=IDKP2*FU(2)/FU(3)/FU(4)**0.5
C
C   SOLVING FOR COMPOSITION
C
      CALL SOLVE(P)
C
C   TEST FOR CONVERGENCE
C
      Q1=A(1)+A(2)+A(3)+A(4)
      Q2=Y(1)+Y(2)+Y(3)+Y(4)
      IF(ZAEHLER .GT. 25.) GOTO 55
      ZAEHLER =ZAEHLER +1
  240 IF(ABS(Q1-Q2).GT.1E-5) GOTO 50
C
C   END OF CALCULATIONS
C
   57 WMA=92.016/(Y(1)+Y(2)+Y(3)+ Y(4))
      RETURN
   55 WRITE 56
   56 FORMAT (20H NO CONVERGENCE                        )
      GOTO 57
      END
      SUBROUTINE KPRS1(P,Z,T,X,LAP)
      DOUBLE PRECISION AZ, ZR
      COMMON /COMPRP1/ NC, ND, PC(5), TC(5), W(5), OMK(10)
C
```

```
      COMMON /PHASED/ FOXP(5,2)
C
      DIMENSION Z(2), X(5,2), A(5), B(5)
      DIMENSION ASUM(5), AL(3), ZR(3), AZ(3)
C
      DATA AOMEGA, BOMEGA, AL, CON1, CON2, CON3 /0.457235530,
     *    0.077796074, 0.37464, 1.54226,-0.26992, 2.414213562,
     *    0.414213562, 2.828427124 /
C
      IF (LAP.GT.1) GO TO 040
C                          SET UP THE METHOD
      DO 020 I = 1, NC
      PR = P / PC(I)
      TR = T / TC(I)
      ALPHA = 1.0+(AL(1)+W(I)*(AL(2)+W(I)*AL(3)))*(1.0-SQRT(TR))
      A(I) = ALPHA * SQRT(AOMEGA*PR) / TR
      B(I) = BOMEGA * PR / TR
  020 CONTINUE
      RETURN
C                          GIVEN COMPOSITIONS OF LIQUID AND VAPOR,
C                          CALCULATE THE FUGACITIES
  040 DO 120 K = 1, 2
      AMX = 0.0
      BMX = 0.0
C                          CALCULATE MIXTURE EOS PARAMETERS
      DO 080 I = 1, NC
      BMX = BMX + X(I,K) * B(I)
      ASUM(I) = 0.0
      DO 060 J = 1, NC
      L = J + I * (I-1) / 2
      IF (J.GT.I) L = I + J * (J-1) / 2
      ASUM(I) = ASUM(I) + X(J,K) * A(J) * OMK(L)
  060 CONTINUE
      ASUM(I) = ASUM(I) * A(I)
      AMX = AMX + X(I,K) * ASUM(I)
  080 CONTINUE
C                          SET UP AND SOLVE THE CUBIC EQUATION
C
      AZ(1) = (-AMX+BMX+BMX*BMX)*BMX
      AZ(2) = AMX-BMX*(3.0*BMX+2.0)
      AZ(3) = BMX-1.0
      CALL CUBIC(AZ,ZR)
      Z(K) = ZR(K)
C                          CALCULATE FUGACITIES
C
      TMP1 = (Z(K)-1.0) / BMX
      TMP2 = -ALOG(Z(K)-BMX)
      TMP3 = -AMX * ALOG((Z(K)+CON1*BMX)/(Z(K)-CON2*BMX)) / (CON3*BMX)
      DO 100 I = 1, NC
      FOPT = B(I) * TMP1 + TMP2 + TMP3 * (2.0*ASUM(I)/AMX-B(I)/BMX)
      FOXP(I,K) = EXP(FOPT)
  100 CONTINUE
  120 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE IDGAS(TT,PP)
      REAL IDKP1,IDKP2
      DIMENSION CP(4,8),DCP(2,8),FH(8),FS(8),RIH(2),RIS(2)
      COMMON /IDGAS/ ICALL,IDKP1,IDKP2
      IF (ICALL.GT.0) GOTO 100
C
C
C   INITIALIZNG FOR N2O4
C
C
       CP(1,1) =  -.292058399952499E+08
       CP(1,2) =   .676082990132626E+06
       CP(1,3) =  -.562268571157538E+04
       CP(1,4) =   .243883323311585E+02
       CP(1,5) =  -.103870287149760E-01
       CP(1,6) =   .395354930826292E-05
       CP(1,7) =  -.562685069621981E-09
       CP(1,8) =   .389814718384088E+01
       CP(2,1) =  -.174393213164685E+08
       CP(2,2) =   .371980567728961E+06
       CP(2,3) =  -.266349925287916E+04
       CP(2,4) =   .114689707309013E+02
       CP(2,5) =  -.614052627994732E-02
       CP(2,6) =   .238635693500449E-05
       CP(2,7) =  -.343371825173331E-09
       CP(2,8) =   .245907250940361E+01
       CP(3,1) =  -.364327537263186E+07
       CP(3,2) =   .744935574860717E+05
       CP(3,3) =  -.464320985759276E+03
       CP(3,4) =   .488453294196981E+01
       CP(3,5) =  -.168691304426562E-02
       CP(3,6) =   .682071825239896E-06
       CP(3,7) =  -.993835608938831E-10
       CP(3,8) =   .141705226300675E+01
       CP(4,1) =  -.854539946938497E+07
       CP(4,2) =   .178416100319674E+06
       CP(4,3) =  -.125687141211197E+04
       CP(4,4) =   .718659032846500E+01
       CP(4,5) =  -.430024013535563E-02
       CP(4,6) =   .176563237990014E-05
       CP(4,7) =  -.250254926328974E-09
       CP(4,8) =   .178302890826438E+01
      R=8.3143
      WMN2O4=92.016
      HF01=9079.28  $  HF02=33095.4  $  HF03=90290.7  $  HF04=0.
      S01=304.277   $  S02=239.923   $  S03=210.652   $  S04=205.033
      C9=3000.
      T0=298.15
      DO 10 I=1,8
      DCP(1,I)=2.*CP(2,I)-CP(1,I)
 10   DCP(2,I)=   CP(3,I)+0.5*CP(4,I)-   CP(2,I)
      DH01=2.*HF02-HF01
      DH02=   HF03+0.5*HF04-   HF02
      DS01=2.*S02-S01
```

```
      DS02=   S03+0.5*S04-   S02
      T=T0
      U=C9/T
      FH(1)=-1./2./T/T
      FH(2)=-1./T
      FH(3)=ALOG(T)
      FH(4)=T
      FH(5)=T*T/2.
      FH(6)=T*T*T/3.
      FH(7)=T*T*T*T/4.
      G=EXP(U)-1.
      FH(8)=C9/G
      FS(1)=-1./3./T/T/T
      FS(2)=FH(1)
      FS(3)=FH(2)
      FS(4)=FH(3)
      FS(5)=FH(4)
      FS(6)=FH(5)
      FS(7)=FH(6)
      FS(8)=FH(8)/T-ALOG(G)+U
      DO 20 I=1,2
      RIH(I)=0.
      RIS(I)=0.
      DO 15 J=1,8
      RIH(I)=RIH(I)+DCP(I,J)*FH(J)
 15   RIS(I)=RIS(I)+DCP(I,J)*FS(J)
 20   CONTINUE
      DH01=DH01-R*RIH(1)
      DH02=DH02-R*RIH(2)
      DS01=DS01-R*RIS(1)
      DS02=DS02-R*RIS(2)
      ICALL=1
C
C
C   CALCULATING IDEAL GAS EQUILIBRIUM CONSTANT
C
C
  100 CONTINUE
      T=TT
      P=PP*9.86923
      U=C9/T
      FH(1)=-1./2./T/T
      FH(2)=-1./T
      FH(3)=ALOG(T)
      FH(4)=T
      FH(5)=T*T/2.
      FH(6)=T*T*T/3.
      FH(7)=T*T*T*T/4.
      G=EXP(U)-1.
      FH(8)=C9/G
      FS(1)=-1./3./T/T/T
      FS(2)=FH(1)
      FS(3)=FH(2)
      FS(4)=FH(3)
```

```
      FS(5)=FH(4)
      FS(6)=FH(5)
      FS(7)=FH(6)
      FS(8)=FH(8)/T-ALOG(G)+U
      DO 30 I=1,2
      RIH(I)=0.
      RIS(I)=0.
      DO 25 J=1,8
      RIH(I)=RIH(I)+DCP(I,J)*FH(J)
25    RIS(I)=RIS(I)+DCP(I,J)*FS(J)
30    CONTINUE
      DH1=DH01+R*RIH(1)
      DH2=DH02+R*RIH(2)
      DS1=DS01+R*RIS(1)
      DS2=DS02+R*RIS(2)
      DG1=DH1-T*DS1
      DG2=DH2-T*DS2
      IDKP1=EXP(-DG1/R/T)
      IDKP2=EXP(-DG2/R/T)
      RETURN
      END
      SUBROUTINE SOLVE(POR)
      REAL KP1,KP2 ,KPOR,N
      DIMENSION Y(4)
      COMMON/SOLVE/KP1,KPOR,Y,WMA
      AL=0.1
      BE=0.01
      ZAHL=1.
      P=POR/0.101325
      KP2=KPOR*KPOR
   20 AL2=AL*AL
      AL3=AL*AL*AL
      ZAHL=ZAHL+1.
      BE2=BE*BE
      BE3=BE*BE*BE
      F1=4*AL2*P*BE2 + AL2*KP1*BE - AL*KP1*BE - 8*AL2*P*BE
      F1=F1 + AL2*KP1 - KP1 + 4*AL2*P
      F11= 8*AL*P*BE2 + 2*AL*KP1*BE - KP1*BE - 16*AL*P*BE
      F11=F11 + 2*AL*KP1 + 8*AL*P
      F12= 8*AL2*P*BE + AL2*KP1 - AL*KP1 - 8*AL2*P
      F2= AL*KP2*BE3 - AL*P*BE3 - AL*KP2*BE2 - KP2*BE2
      F2=F2 - AL*KP2*BE - 2*KP2*BE +AL*KP2 +KP2
      F21 = KP2*BE3 - P*BE3 - KP2*BE2 - KP2*BE + KP2
      F22= 3*AL*KP2*BE2 - 3*AL*P*BE2 - 2*AL*KP2*BE + 2*KP2*BE
      F22 = F22 - AL*KP2 - 2*KP2
      IF (ABS(F1).LE.1E-5 .AND. ABS(F2).LE.1E-5) GOTO 100
      DET = F11*F22 - F12*F21
      IF(ZAHL.GE.25) GOTO 110
      D1= (F12*F2 - F22*F1) / DET
      D2 = (F21*F1 - F11*F2) / DET
      AL = AL + D1
      BE = BE + D2
      GOTO 20
  110 WRITE 200
```

```
  200 FORMAT (30H NO CONVERGENCE IN SOLVE
      N= 1 + AL + AL*BE
      IF (N.GT.1.) N=1.
      GOTO 115
  100 N=1+AL+AL*BE
  115 WMA=92.016/N
      Y(1)=1-AL
      Y(2)=2*AL - 2*AL*BE
      Y(3)=2*AL*BE
      Y(4)=AL*BE
      RETURN
      END
      SUBROUTINE KPRS2(P,Z,T,X,LAP)
      DOUBLE PRECISION AZ, ZR
      COMMON /COMPRP2/ NC, ND, PC(5), TC(5), W(5), OMK(10)
C
      COMMON /PHASED/ FOXP(5,2)
C
      DIMENSION Z(2), X(5,2), A(5), B(5)
      DIMENSION ASUM(20), AL(3), ZR(3), AZ(3)
C
      DATA AOMEGA, BOMEGA, AL, CON1, CON2, CON3 /0.457235530,
     *    0.077796074, 0.37464, 1.54226,-0.26992, 2.414213562,
     *    0.414213562, 2.828427124 /
C
      IF (LAP.GT.1) GO TO 040
C                          SET UP THE METHOD
      DO 020 I = 1, NC
      PR = P / PC(I)
      TR = T / TC(I)
      ALPHA = 1.0+(AL(1)+W(I)*(AL(2)+W(I)*AL(3)))*(1.0-SQRT(TR))
      A(I) = ALPHA * SQRT(AOMEGA*PR) / TR
      B(I) = BOMEGA * PR / TR
  020 CONTINUE
      RETURN
C                          GIVEN COMPOSITIONS OF LIQUID AND VAPOR,
C                          CALCULATE THE FUGACITIES
  040 DO 120 K = 1, 2
      AMX = 0.0
      BMX = 0.0
C                          CALCULATE MIXTURE EOS PARAMETERS
      DO 080 I = 1, NC
      BMX = BMX + X(I,K) * B(I)
      ASUM(I) = 0.0
      DO 060 J = 1, NC
      L = J + I * (I-1) / 2
      IF (J.GT.I) L = I + J * (J-1) / 2
      ASUM(I) = ASUM(I) + X(J,K) * A(J) * OMK(L)
  060 CONTINUE
      ASUM(I) = ASUM(I) * A(I)
      AMX = AMX + X(I,K) * ASUM(I)
  080 CONTINUE
C                          SET UP AND SOLVE THE CUBIC EQUATION
C
```

```
      AZ(1) = (-AMX+BMX+BMX*BMX)*BMX
      AZ(2) = AMX-BMX*(3.0*BMX+2.0)
      AZ(3) = BMX-1.0
      CALL CUBIC(AZ,ZR)
      Z(K) = ZR(K)
C                          CALCULATE FUGACITIES
C
      TMP1 = (Z(K)-1.0) / BMX
      TMP2 = -ALOG(Z(K)-BMX)
      TMP3 = -AMX * ALOG((Z(K)+CON1*BMX)/(Z(K)-CON2*BMX)) / (CON3*BMX)
      DO 100 I = 1, NC
      FOPT = B(I) * TMP1 + TMP2 + TMP3 * (2.0*ASUM(I)/AMX-B(I)/BMX)
      FOXP(I,K) = EXP(FOPT)
  100 CONTINUE
  120 CONTINUE
      RETURN
      END
      SUBROUTINE CUBIC(A,Z)
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      DIMENSION A(3), Z(3)
      LOGICAL ENTER
      DATA ENTER, PI /.FALSE., 3.14159265358 /
C
C                          ON FIRST ENTRY INITIALIZE CONSTANTS
C
      IF (ENTER) GO TO 020
      ENTER = .TRUE.
      HPI = 0.5 * PI
      ADD1 = 2.0 * PI / 3.0
      ADD2 = 2.0 * ADD1
C
C                          SEE HOW MANY REAL ROOTS EXIST
  020 A0 = A(1)
      A1 = A(2)
      A2 = A(3) / 3.0
      Q = A1 / 3.0 - A2 * A2
      R = (A1 * A2 - A0) / 2.0 - A2 * A2 * A2
      TEST = Q * Q * Q + R * R
      IF (TEST.LT.0.0) GO TO 040
C
C                          EITHER ONE REAL OR THREE REAL WITH TWO
C                          IDENTICAL ROOTS
      TEST=DSQRT(TEST)
      S1 = DCBRT(R+TEST)
      S2 = DCBRT(R-TEST)
      Z(1) = S1 + S2 - A2
      Z(2) = Z(1)
      Z(3) = Z(1)
      IF (TEST.GT.0.0) RETURN
C
C                          THREE REAL WITH TWO IDENTICAL
C
      Z(2) = -0.5 * (S1+S2) - A2
      Z(3) = Z(2)
```

```
      GO TO 060
C                          IRREDUCIBLE CASE, THREE REAL ALL DIFFERENT
C
  040 TEST = DSQRT(-TEST)
      Q = 2.0 * DCBRT(DSQRT(R*R+TEST*TEST))
      THETA = HPI
      IF (R.NE.0.0) THETA = DATAN(TEST/R)
      IF (THETA.LT.0.0) THETA = THETA + PI
      THETA = THETA / 3.0
      Z(1) = Q * DCOS(THETA) - A2
      Z(2) = Q * DCOS(THETA+ADD1) - A2
      Z(3) = Q * DCOS(THETA+ADD2) - A2
C
C                          ORDER THE ROOTS AND RETURN
C
  060 ZMIN =DMIN1(Z(1),Z(2),Z(3))
      Z(2) =DMAX1(Z(1),Z(2),Z(3))
      Z(1) = ZMIN
      IF (ZMIN.LT.0.0) Z(1) = Z(2)
      RETURN
      END
      FUNCTION DCBRT(X)
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      SIGN=1.0
      IF (X.LT.0.0) SIGN=-SIGN
      DCBRT=SIGN*DABS(X)**(1.0/3.0)
      RETURN
      END
      SUBROUTINE DATAO4
      DIMENSION G(32),VP(9),GI(11)
      DIMENSION GV(9),GT(9),FV(4),FT(4),EV(8),ET(8)
      DIMENSION A(20)
      COMMON/SEN/BETA,XO,DELTA,E1, E2, AGAM
      COMMON/CPID/GI
      COMMON/CRIT/ EM, EOK, RM, TC, DC, X , PC, SIG
      COMMON/DATA/G,R,GAMMA,VP,DTP,PCC,PTP,TCC,TTP,TUL,TLL,PUL,DCC
     1,TO,SO,HO
      COMMON/DATA1/GV,GT,FV,FT,EV,ET
      COMMON/ISP/N,NW,NWW,IO4
      COMMON/SATC/A,DTPV
      R=.0831434
      GAMMA=-.00698534
      DCC=6.168
      TCC=431.372
```

```
PCC=101.578
TTP=261.95
DTP=16.512
DTPV=.008071
PTP=.186357
 A(14) =  -.229633432352639D+02
 A(15) =   .444180675718735D-01
 A(16) =  -.131600592054883D+01
 A(17) =   .196616243521867D+02
 A(18) =  -.128333984017111D+03
 A(19) =   .583946712735953D+02
 A(20) =  -.138224711004156D+02
 A(1) =  -.521510952192793D+02
 A(2) =   .833097054690417D-01
 A(3) =  -.253065059490397D+01
 A(4) =   .398803903385751D+02
 A(5) =  -.343846886075897D+03
 A(6) =   .213074297013542D+03
 A(7) =  -.962198719084613D+02
 A(8) =   .242464617272577D+02
 A(9) =  -.240961969709632D+01
A(10)=A(11)=A(12)=A(13)=0
G( 1)= .4597288294960E   1
G( 2)=-.3108186436820E   3
G( 3)= .6112269850945E   4
G( 4)=-.8731107718865E   6
G( 5)= .7131502732444E   8
G( 6)=-.8503143207520E  -1
G( 7)= .1445089748309E   3
G( 8)=-.8889859726204E   5
G( 9)=-.4972864113577E  10
G(10)= .2981177472533E  -2
G(11)=-.4158172441021E   1
G(12)= .2034429884777E   4
G(13)=-.4689856409790E  -1
G(14)= .1588311134660E   2
G(15)= .3679927660876E   5
G(16)=-.1540646222658E   1
G(17)= .4673519598527E  -1
G(18)= .7943347561001E   3
G(19)=-.2363315312354E   2
G(20)= .4996063055910E  10
G(21)=-.2341513119386E  10
G(22)= .3472302954074E   8
```

```
      G(23)=-.1096418697345E  10
      G(24)= .1138607201773E   6
      G(25)=-.8323163631149E   5
      G(26)= .2114987911869E   3
      G(27)= .8381093547965E   5
      G(28)= .2821172946546E   0
      G(29)=-.3595116964296E   1
      G(30)= .1739254252424E  -3
      G(31)= .1280112610521E  -1
      G(32)=-.8129759389399E   0
      VP(6)=PTP
      VP(1) =    .568098761480988E+01
      VP(2) =    .472562948273682E+00
      VP(3) =    .103600373744947E+00
      VP(9) =    .437638859066150E-01
      VP(4) =    .367422170556461E+00
      VP(5)=1.5
      VP(7)=TTP
      VP(8)=TCC
      N=0
      NW=0
      NWW=0
      IO4=1
       RETURN
      END
      SUBROUTINE PROPS(PP,DD,TT)
      DIMENSION X(33)
      DIMENSION B(33),G(32)
      EQUIVALENCE (B,X)
      COMMON/DATA/G,R,GAMMA
```

```
      COMMON/1/B
      DATA(ID=1)
      DATA(IZ=1)
    1 CONTINUE
      IF(IZ.LE.0)GO TO 2
      IZ=0
    2 CONTINUE
      D=DD
      P=PP
      T=TT
      GM=GAMMA
      D2=D*D
      D3=D2*D
      D4=D3*D
```

```
      D5=D4*D
      D6=D5*D
      D7=D6*D
      D8=D7*D
      D9=D8*D
      D10=D9*D
      D11=D10*D
      D12=D11*D
      D13=D12*D
      TS=SQRT (T)
      T2=T*T
      T3=T2*T
      T4=T3*T
      T5=T4*T
      F=EXP (GM*D2)
      GO TO (100,200,300),K
      ENTRY PRESS
C     ENTRY FOR PRESSURE, INPUT IS DENSITY
C     AND TEMP. IN MOL/L AND K, OUTPUT IS IN ATM.
      K=1
      GO TO 1
  100 CONTINUE
      B( 1)=D2*T
      B( 2)=D2*TS
      B( 3)=D2
      B( 4)=D2/T
      B( 5)=D2/T2
      B( 6)=D3*T
      B( 7)=D3
      B( 8)=D3/T
      B( 9)=D3/T2
      B(10)=D4*T
      B(11)=D4
      B(12)=D4/T
      B(13)=D5
      B(14)=D6/T
      B(15)=D6/T2
      B(16)=D7/T
      B(17)=D8/T
      B(18)=D8/T2
      B(19)=D9/T2
```

```
      B(20)=D3*F/T2
      B(21)=D3*F/T3
      B(22)=D5*F/T2
```

```
      B(23)=D5*F/T4
      B(24)=D7*F/T2
      B(25)=D7*F/T3
      B(26)=D9*F/T2
      B(27)=D9*F/T4
      B(28)=D11*F/T2
      B(29)=D11*F/T3
      B(30)=D13*F/T2
      B(31)=D13*F/T3
      B(32)=D13*F/T4
      IF(ID.GT.0)GO TO 102
      B(33)=P-R*D*T
      RETURN
  102 P=0
      M=32
      DO 101 I=1,M
  101 P=P+B(I)*G(I)
      P=P+R*D*T
      PP=P
      RETURN
      ENTRY DPDD
C     PARTIAL OF PRESSURE WITH RESPECT TO
C     DENSITY - SEE PRESSURE
C     ENTRY FOR UNITS
      K=2
      GO TO 1
  200 CONTINUE
      F1=2.00*F*GM*D
      F21=3.000*F*D2 +F1*D3
      F22=5.000*F*D4 +F1*D5
      F23=7.000*F*D6 +F1*D7
      F24=9.000*F*D8 +F1*D9
      F25=11.00*F*D10+F1*D11
      F26=13.00*F*D12+F1*D13
      B( 1)=2.00*D*T
      B( 2)=2.00*D*TS
      B( 3)=2.00*D
      B( 4)=2.00*D/T
      B( 5)=2.00*D/T2
      B( 6)=3.00*D2*T
      B( 7)=3.00*D2
      B( 8)=3.00*D2/T
      B( 9)=3.00*D2/T2
      B(10)=4.00*D3*T
      B(11)=4.00*D3
      B(12)=4.00*D3/T
      B(13)=5.00*D4
      B(14)=6.00*D5/T
      B(15)=6.00*D5/T2
      B(16)=7.00*D6/T
      B(17)=8.00*D7/T
      B(18)=8.00*D7/T2
```

```
      B(19)=9.00*D8/T2
      B(20)=F21/T2
      B(21)=F21/T3
      B(22)=F22/T2
      B(23)=F22/T4
      B(24)=F23/T2
      B(25)=F23/T3
      B(26)=F24/T2
      B(27)=F24/T4
      B(28)=F25/T2
      B(29)=F25/T3
      B(30)=F26/T2
      B(31)=F26/T3
      B(32)=F26/T4
      M=32
      IF(ID.GT.0)GO TO 202
      B(33)=P-R*T
      RETURN
  202 P=0
      DO 201 I=1,M
  201 P=P+B(I)*G(I)
      P=P+R*T
      PP=P
      RETURN
      ENTRY DPDT
C     PARTIAL OF PRESSURE WITH RESPECT
C     TO TEMPERATURE - SEE PRESSURE
C     ENTRY FOR UNITS
      K=3
      GO TO 1
  300 CONTINUE
      X( 1)=D2
      X( 2)=D2/(2.00*TS)
      X( 3)=0
      X( 4)=-D2/T2
      X( 5)=-2.00*D2/T3
      X( 6)=D3
      X( 7)=0
      X( 8)=-D3/T2
      X( 9)=-2.00*D3/T3
      X(10)=D4
      X(11)=0
      X(12)=-D4/T2
      X(13)=0
      X(14)=-D6/T2
      X(15)=-2.00*D6/T3
      X(16)=-D7/T2
      X(17)=-D8/T2
      X(18)=-2.00*D8/T3
      X(19)=-2.00*D9/T3
      X(20)=-2.00*D3*F/T3
      X(21)=-3.00*D3*F/T4
      X(22)=-2.00*D5*F/T3
      X(23)=-4.00*D5*F/T5
      X(24)=-2.00*D7*F/T3
```

```
      X(25)=-3.00*D7*F/T4
      X(26)=-2.00*D9*F/T3
      X(27)=-4.00*D9*F/T5
      X(28)=-2.00*D11*F/T3
      X(29)=-3.00*D11*F/T4
      X(30)=-2.00*D13*F/T3
      X(31)=-3.00*D13*F/T4
      X(32)=-4.00*D13*F/T5
      IF(ID.GT.0)GO TO 302
      X(33)=PP-R*D
      RETURN
  302 P=0
      DO 301 I=1,32
  301 P=P+G(I)*X(I)
      PP=P+R*D
      RETURN
      END
      FUNCTION VPN(TT)
C     CALCULATES VAPOR PRESSURE IN ATMOSPHERES
C     FOR AN INPUT TEMPERATURE IN KELVIN
      DIMENSION G(32),VP(9)
      COMMON/DATA/G,R,GAMMA,VP
      T=TT
      X=(1.-VP(7)/T)/(1.-VP(7)/VP(8))
      VPN=VP(6)*EXP (VP(1)*X+VP(2)*X*X+VP(3)*X**3+VP(9)*X**4+VP(4)*X*
     1(1.-X)**VP(5))
      RETURN
      END
      FUNCTION FINDTV(POBS)
C     ITTERATES THE VAPOR PRESSURE EQUATION
C     FOR A TEMPERATURE ( IN KELVIN)
C     GIVEN AN INPUT PRESSURE IN ATMOSPHERES
      COMMON/DATA/G,R,GAMMA,VP,DTP
      DIMENSION G(32),VP(9)
      T=VP(8)
      DO 7 I=1,10
      P=VPN(T)
      IF(ABS (P-POBS)-.000001*POBS)8,8,6
    6 CONTINUE
      CORR=(POBS-P)/DPDTVP(T)
    7 T=T+CORR
    8 CONTINUE
      FINDTV=T
      RETURN
      END
      FUNCTION FIND D(P,T)
C     ITTERATES EQUATION OF STATE
C     FOR DENSITY, GIVEN PRESSURE
C     AND TEMP. IN ATM. AND KELVIN.  IF
C     ITTERATION FAILS TRY USING
C     FUNCTION CALLED FIND M
      DIMENSION G(32),VP(9)
      COMMON/DATA/G,R,GAMMA,VP,DTP,PCC,PTP,TCC,TTP,TUL,PUL,DCC
      TT=T
      IF(TT.GT.VP(8))GO TO 100
```

```
      IF( P.GT.VPN(TT))GO TO 101
      DD=SATV(TT)
      GO TO 102
  100 PC=PCC/1.013^5
      X=(1.1/(9.*PC))*P+.7/9.
      DD=P/(R*T*X)
      IF(P/PC.GT.20..AND.T/VP(8).LT.2.5)DD=DTP
      GO TO 102
  101 DD=SATL(TT)
  102 CONTINUE
      DO 10 I=1,50
      IF(DD.LE.0.0.OR.DD.GT.50.)GO TO 11
      CALL PRESS(PP,DD,TT)
      IF(PP.LE.0.0)GO TO 11
      P2=PP
      IF(ABS (P-P2)-1.E-7*P)20,20,1
    1 CALL DPDD(PP,DD,TT)
      DP=PP
      CORR=(P2-P)/DP
      IF(ABS (CORR)-1.E-7*DD)20,20,10
   10 DD=DD-CORR
   11 CALL REGULA(P,DD,T)
   20 FIND D=DD
      RETURN
      END
      SUBROUTINE REGULA(PI,DD,TT)
C     ITTERATES EQUATION OF STATE FOR DENSITY WHEN FIND D FAILS
      DIMENSION G(32),VP(9)
      COMMON/DATA/G,R,GAMMA,VP,DTP,PCC,PTP,TCC,TTP,TUL,TLL,PUL,DCC
      T=TT
      P=PI
      D2=0
      IF(T.LT.TCC)GO TO 10
      D0=DCC*TCC/T
      GO TO 20
   10 PP=VPN(T)
      IF(P.GT.PP)GO TO 15
      D0=SATV(T)
      DO 11 I=1,150
      CALL PRESS(P0,D0,T)
      IF(P0.GE.P)GO TO 12
   11 D0=D0+.0001*D0
      GO TO 42
   12 D1=D0
   13 CALL PRESS(P1,D1,T)
      IF(P1.LT.P)GO TO 14
      IF(D1.LE..1*PTP)GO TO 42
      D0=D1
      Z=(P1-P)/P
      IF(Z.LT..1)Z=.1
      IF(Z.GT..9)Z=.9
      D1=D1-Z*D1
      GO TO 13
   14 CALL PRESS(P0,D0,T)
      DO 140 I=1,50
```

```
      D=D1
      P3=P1
      IF(ABS(P-P1).LT..00001*P)GO TO 40
      P2=P-P1
      D1=D1+(D1-D0)*P2/(P1-P0)
      IF(ABS(D-D1).LE..00001*D)GO TO 40
      IF(ABS(P-P1).LT..005*P)D2=FIND M(P,T,D1)
      IF(D2.GT.0.0.AND.D2.LT.50.)D1=D2
      D2=0
      CALL PRESS(P1,D1,T)
      IF(P0.GT.P.AND.P1.GT.P)GO TO 120
      IF(P0.LT.P.AND.P1.LT.P)GO TO 120
      GO TO 140
  120 P0=P3
      D0=D
  140 CONTINUE
      GO TO 41
   15 D0=SATL(T)
      DO 16 I=1,10
      CALL PRESS(P0,D0,T)
      IF(P0.LE.P)GO TO 17
   16 D0=D0-.0001*D0
      GO TO 42
   17 D1=D0
   18 CALL PRESS(P1,D1,T)
      IF(D1.GE.50.)GO TO 42
      IF(P1.GT.P)GO TO 14
      D0=D1
      Z=(P-P1)/P
      Z=Z*10
      IF(T/TCC.LT..6)Z=1.
      IF(Z.LT.1.)Z=1.
      IF(Z.GT.9.)Z=9.
      D1=D1+.01*D1*Z
      GO TO 18
   20 CALL PRESS(P0,D0,T)
      IF(P.LE.P0)GO TO 30
      D1=D0
   21 CALL PRESS(P1,D1,T)
      IF(P1.GE.P)GO TO 14
      IF(D1.GE.50.)GO TO 42
      D0=D1
      Z=(P-P1)/P
      Z=Z*10
      IF(Z.LT.1)Z=1
      IF(Z.GT.9)Z=9
      D1=D1+.1*D1*Z
      GO TO 21
   30 D1=D0
   31 CALL PRESS(P1,D1,T)
      IF(P1.LE.P)GO TO 14
      IF(D1.LE..1*PTP)GO TO 42
      D0=D1
      Z=(P1-P)/P
      Z=Z*10
```

```
      IF(Z.LT.1)Z=1
      IF(Z.GT.9)Z=9
      D1=D1-.1*D1*Z
      GO TO 31
   40 DD=D1
      RETURN
   41 PRINT 101,P,T,D
  102 FORMAT(* REGULA FAILED AT P=*,F7.2,* AND T=*,F7.2)
  101 FORMAT(* DENSITY ITTERATION FAILED AT P=*,F7.2,* AND T=*,F7.2,
     1/* DENSITY RETURNED IS*,E17.8)
      RETURN
   42 PRINT 102,P,T
      RETURN
      END
      FUNCTION DPDTVP(TT)
C     CALCULATES THE DERIVATIVE OF PRESSURE
C     WITH RESPECT TO TEMPERATURE AT
C     SATURATION.  INPUT IS TEMP. IN K, OUTPUT IS ATM/K.
      COMMON/DATA/G,R,GAMMA,VP
      DIMENSION G(32),VP(9)
      T=TT
      IF(TT.GT.VP(8))GO TO 1
      X=(1.-VP(7)/T)/(1.-VP(7)/VP(8))
      DXDT=(VP(7)/T**2)/(1.-VP(7)/VP(8))
      DPDT=VP(1)*DXDT+2.*VP(2)*X*DXDT+VP(3)*3.*X**2*DXDT+VP(4)*
     1((1.-X)**VP(5))*DXDT+VP(4)*X*((1.-X)**(VP(5)-1.))*VP(5)*(-DXDT)
     2+VP(9)*4*X**3*DXDT
      DPDT=DPDT*VPN(T)
      DPDTVP=DPDT
      RETURN
    1 DPDTVP=0
      RETURN
      END
      FUNCTION FIND M(P,T,DD)
C     ALTERNATIVE FOR FIND D, INPUT IS
C     PRESSURE IN ATM., T IN KELVIN AND
C     DENSITY IN MOL/L.  INPUT DENSITY
C     IS A STARTING VALUE FOR ITTERATION
C     OF EQUATION OF STATE FOR SOLUTION FOR P AND T
      TT=T
      DO 10 I=1,50
      CALL PRESS(PP,DD,TT)
      P2=PP
      IF(ABS (P-P2)-1.E-7*P)20,20,1
    1 CALL DPDD(PP,DD,TT)
      DP=PP
      CORR=(P2-P)/DP
      D=DD
      IF(ABS (CORR)-1.E-7*D)20,20,10
   10 DD=DD-CORR
      FIND M=0
      RETURN
   20 FIND M=DD
      RETURN
      END
```

```
      FUNCTION SATL(TT)
C     CALCULATES THE DENSITY OF THE
C     SATURATED LIQUID AT TEMP., T IN KELVIN.
C     OUTPUT IS IN MOL/L.
      DIMENSION A(20)
      DIMENSION G(32),VP(9)
      COMMON/DATA/G,R,GAMMA,VP,DTP,PCC,PTP,TCC,TTP,TUL,TLL,PUL,DCC
      COMMON/SATC/A,DTPV
      K=14
      KK=7
      GO TO 10
      ENTRY SATV
      K=1
      KK=13
   10 IF(T.GE.TCC)GO TO 20
      T=TT
      ITT=TCC
      IF(ITT+1-T.LT.1.)T=ITT
      X=(T-TCC)/(TTP-TCC)
      D=A(K)*ALOG(X)
      DO 11 I=2,KK
      K=K+1
      MM=I
      IF(MM.GE.5)MM=MM+1
   11 D=D+A(K)*(1.-X**((MM-5)/3.))
      IF(K.LT.14)GO TO 12
      D=DCC+EXP(D)*(DTP-DCC)
      GO TO 13
   12 D=DCC+EXP(D)*(DTPV-DCC)
   13 SATL=D
      IF(ITT+1-TT.LT.1.)SATL=D-(D-DCC)*(TT-T)/(TCC-T)
      RETURN
   20 DSATL=DCC
      RETURN
      END
```

NBS-114A (REV. 2-80)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET (See instructions)	1. PUBLICATION OR REPORT NO. NBSIR 86-3054	2. Performing Organ. Report No.	3. Publication Date July 1986

4. TITLE AND SUBTITLE

THE THERMODYNAMIC PROPERTIES OF NITROGEN TETROXIDE

5. AUTHOR(S)

Robert D. McCarty, Hans-Ulrich Steurer, and C. M. Daily

6. PERFORMING ORGANIZATION (If joint or other than NBS, see instructions)

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

7. Contract/Grant No.

8. Type of Report & Period Covered

9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP)

NASA
John F. Kennedy Space Center, Florida 32899

10. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

A mathematical model of the equation of state of nitrogen tetroxide is presented. Isobaric tables of P-ρ-T and composition for temperatures from the triple point (261.95 K) to 600 K with pressures to 40 MPa are also given. The mathematical model of the equation of state is a 32 term modified Benedict-Webb-Rubin equation. A method of calculating chemical equilibrium for the system is also presented.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

chemical equilibrium; composition; density; equation of state; nitrogen tetroxide; pressure; temperature.

13. AVAILABILITY

☒ Unlimited

☐ For Official Distribution. Do Not Release to NTIS

☐ Order From Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

☒ Order From National Technical Information Service (NTIS), Springfield, VA. 22161

14. NO. OF PRINTED PAGES

106

15. Price

USCOMM-DC 6043-P80

☆U.S. GOVERNMENT PRINTING OFFICE 1986—672-455/45274