Thermodynamic Properties of Nitrogen from the Freezing Line to 2000 K at Pressures to 1000 MPa

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A new fundamental equation explicit in Helmholtz energy for thermodynamic properties of nitrogen from the freezing line to 2000 K at pressures to 1000 MPa is presented. New independent equations for the vapor pressure and for the saturated liquid and vapor densities as functions of temperature are also included. The fundamental equation was selected from a comprehensive function of 100 terms on the basis of a statistical analysis of the quality of the fit. The coefficients of the fundamental equation were determined by a weighted least-squares fit to selected P-ρ-T data, saturated liquid, and saturated vapor density data to define the phase equilibrium criteria for coexistence, and velocity of sound data. The fundamental equation and the derivative functions for calculating internal energy, enthalpy, entropy, isochoric heat capacity (C_v), isobaric heat capacity (C_p), and velocity of sound are included. Tables of thermodynamic properties of nitrogen are given for liquid and vapor states within the range of validity of the fundamental equation. The fundamental equation reported here may generally be used to calculate pressures and densities with an uncertainty of $\pm 0.1\%$, heat capacities within $\pm 3\%$, and velocity of sound values within $\pm 1\%$. Comparisons of calculated properties to experimental data are included to verify the accuracy of the formulation.

Key words: density; enthalpy and entropy; equation of state; nitrogen; heat capacity; property table; thermodynamic properties; velocity of sound.

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Nomenclature

Symbol	Physical quantity	Unit
T	Temperature	K
P	Pressure	MPa
ρ	Density	mol/dm^3
v	Molar volume	dm^3/mol
Z	Compressibility factor, $Z = P/\rho RT$	
U	Internal energy	J/mol
A	Helmholtz energy	J/mol
G	Gibbs energy	J/mol
H	Enthalpy	J/mol
S	Entropy	J/(mol K)
C_p	Isobaric heat capacity	J/(mol K)
C_v	Isochoric heat capacity	J/(mol K)
C_σ	Two-phase heat capacity	J/(mol K)
γ	Heat capacity ratio	
W	Velocity of sound	m/s
B	Second virial coefficient	dm^3/mol
C	Third virial coefficient	(dm^3/mol)^2
D	Fourth virial coefficient	(dm^3/mol)^3
$(\partial P/\partial\rho)_T$	Isotherm derivative	dm^3 MPa/mol
$(\partial P/\partial T)_\rho$	Isochore derivative	MPa/K
R	Gas constant (8.314 34)	J/(mol K)
M	Molecular weight of nitrogen (28.0134)	
α	Reduced Helmholtz energy, $\alpha = A/RT$	
τ,θ	Reduced temperature, $\tau = T_c/T$	
δ	Reduced density, $\delta = \rho/\rho_c$	

Superscript	
o	Ideal gas property

Subscripts	
0	Reference state property
c	Critical-point property
σ	Property at saturation
tp	Triple point property
eqn	Calculated using an equation
data	Experimental value
nbp	Normal boiling point
SV	Saturated vapor
SL	Saturated liquid
tpv	Triple point (vapor)
tpl	Triple point (liquid)

Additional abbreviations	
exp	Exponential function
Δ	Difference

Fixed Points for Nitrogen

Symbol	Quantity	Value
T_c	Critical temperature	126.193 K
P_c	Critical pressure	3.3978 MPa
ρ_c	Critical density	11.177 mol/dm^3
T_{tp}	Triple point temperature	63.148 K
P_{tp}	Triple point pressure	0.012 52 MPa
ρ_{tpv}	Triple point density (vapor)	0.024 10 mol/dm^3
ρ_{tpl}	Triple point density (liquid)	31.046 mol/dm^3
T_{nbp}	Normal boiling point temperature	77.348 K
ρ_{nbpv}	Normal boiling density (vapor)	0.1650 mol/dm^3
ρ_{nbpl}	Normal boiling density (liquid)	28.794 mol/dm^3
T_0	Reference temperature	298.15 K
H_0°	Reference enthalpy at T_0	8669 J/mol
S_0°	Reference entropy at T_0	191.502 J/mol K

1. Introduction

Nitrogen is produced commercially in large-scale plants and is widely used for scientific and industrial purposes. Accurate tables of thermodynamic and transport properties of nitrogen are essential for industrial equipment design, safe cryogenic storage, and equitable custody transfer.

Throughout this manuscript the word "data" is used to refer to experimental measurements. The term "formulation" refers to the equation or equations necessary to calculate fluid properties from a correlation. The term "fundamental equation" is used to describe the equation of state used in this work. The ideal gas heat capacity representation is an integral part of the fundamental equation. A separate equation for ideal gas heat capacity is also given. Ancillary equations for the vapor pressure, saturated liquid density, and saturated vapor density are used to calculate values to define liquid–vapor coexistence states in the development of the fundamental equation. These ancillary equations are also useful as estimating functions for defining saturated states using the Maxwell criterion for phase equilibrium.

1.1. Prior Correlations of Nitrogen Properties

A comprehensive correlation and evaluation of nitrogen data was reported by Jacobsen and Stewart[1] in 1973. This work was the basis for an international table of properties of nitrogen published by Angus *et al.*[2] in 1979. This work has been the accepted standard for thermodynamic properties of nitrogen since its publication.

Jacobsen and Stewart[1] and Angus *et al.*[2] discussed several correlations published prior to 1973. Although these correlations are of historical interest, they are not discussed in detail here. These earlier correlations, especially that of Strobridge,[3] provided interim properties of nitrogen for use in commerce, and perhaps more significantly, created an awareness of the need for more accurate experimental property measurements and more accurate correlation methods.

Jacobsen and Stewart[1] extended the ranges of validity of the prior correlations for nitrogen in temperature and pressure and introduced a 32-term pressure-explicit equation of state for nitrogen. This pressure-explicit equation form has been widely used for correlating properties of other fluids. This equation of state was also used in the National Bureau of Standards (NBS) Technical Note No. 648,[4] which was published for engineering use in customary engineering (British) units. Based upon comparisons of calculated properties of nitrogen from these prior correlations to experimental data, it was recognized that improvements in the accuracy of the equation of state were needed for the critical region and the low-temperature liquid and vapor regions. This work represents an improvement over prior correlations in these regions. An additional reason for this new formulation is the availability of new data for various thermodynamic properties, and the development of new techniques of correlation.

1.2. The Fundamental Equation for Nitrogen

The fundamental equation used in this work is explicit in reduced Helmholtz energy. Other thermodynamic properties are derived from the fundamental equation by differentiation. The coefficients of the fundamental equation were determined using a least-squares regression procedure[5,6] for selection of an optimum group of terms from an initial bank of 100 proposed terms. The range of validity of the fundamental equation for nitrogen is from the freezing line to 2000 K at pressures to 1000 MPa. With a few exceptions, the equation presented here represents the selected experimental P-ρ-T data to within the estimated accuracies of these data.

Throughout this paper, comparisons of calculated properties to experimental data are used as the basis for validity and estimated accuracy of the correlation. In all comparisons given, percentage deviations are defined as

$$[(X_{data} - X_{eqn})/(X_{data})] \times 100, \quad (1.1)$$

where X is the property compared. Detailed comparisons of

calculated thermodynamic properties to experimental data are given in Sec. 6.

In addition to the fundamental equation, ancillary functions including a vapor pressure equation, equations for the density of the saturated liquid and saturated vapor, and an equation for the ideal gas heat capacity are given. Summaries of the available data for coexistence properties of nitrogen are given, and the ranges of these data are tabulated.

The fundamental equation may be used for the calculation of accurate tables of thermodynamic properties of nitrogen within its range of applicability. This equation may also be readily used for systems analysis where iterative solutions are required to solve the equation for variable pairs other than density and temperature. The fundamental equation was developed to conform to the Maxwell criterion for liquid–vapor phase equilibrium. The fundamental equation given here is accurate in the critical region to within 0.1% in pressure. However, for accurate property determination in the critical region, the revised and extended scaling formulation of Jahangiri and Jacobsen[7] should be used.

The thermodynamic property correlation for nitrogen reported here includes specific improvements over that of Jacobsen and Stewart.[1] Saturated liquid and vapor densities consistent with the best single-phase data in adjacent regions have been used in the development of the formulation. The techniques first applied in the correlation of thermodynamic properties of ethylene by Jahangiri *et al.*[8] to improve the accuracy of calculated properties in the critical region were used in the development of this formulation for nitrogen. The accuracy of derived properties including heat capacities and velocity of sound has been improved from that of Jacobsen and Stewart.[1]

2. Experimental Data for the Single-Phase Region

The available experimental data for nitrogen are summarized in the following sections. These data were the basis for the development of the new thermodynamic property formulation reported here. Some of the data in the selected data sets were not used in determining the coefficients for the fundamental equation. However, all available data were compared to values calculated with the formulation. Sources for experimental property data with temperature, pressure and density ranges, uncertainties, and sample purities are tabulated. The data for the coexistence states (liquid–vapor and solid–liquid) are discussed and summarized in Secs. 3 and 4.

2.1. P-ρ-T Data

The experimental P-ρ-T data for nitrogen are summarized in Table 1. The distribution of these data is shown in Figs. 1–5. Five separate graphs were used to illustrate these data because of the large number of available P-ρ-T data for nitrogen. The data selected for the determination of the coefficients of the fundamental equation are illustrated in Fig. 1. Data from the same sources as those in Fig. 1 that were not used in the fit are illustrated in Fig. 2. The data illustrated in Figs. 3 and 4 were not used in the fit. Further discussion of the data selection is given in Sec. 5. For clarity of illustration, P-ρ-T data for nitrogen in the critical region are shown separately in Fig. 5.

2.2. Isochoric and Isobaric Heat Capacity

The reported measurements of the isochoric heat capacity, isobaric heat capacity, and heat capacity of the saturated liquid for nitrogen are summarized in Tables 2, 3, and 4. Figure 6 shows most of the recent experimental heat capacity data for nitrogen on P–T coordinates, including the values of saturated liquid heat capacity from several authors.

2.3. Velocity of Sound Data

Extensive measurements of the velocity of sound for nitrogen have been reported, especially in the vapor region. The sources of these data are summarized in Table 5, and Fig. 7 shows the distribution of these data on P–T coordinates.

2.4. Virial Coefficients

There are many published values for the second virial coefficients of nitrogen for temperatures from 70 to 1000 K. In the opinion of the authors, the most reliable second virial coefficients available are those of Levelt Sengers *et al.*[82] Discrepancies of the values from other sources with the selected data may be attributed to the associated experimental and correlating procedures and to considerations of impurities and adsorption. Table 6 summarizes the sources for the virial coefficients for nitrogen. Only the values of Levelt Sengers *et al.*[82] compiled and recorrelated from other sources were used for comparisons in this work.

2.5. Enthalpy Data

The sources of enthalpy data considered in this work are summarized in Table 7. These values have been used only for comparison to calculated values.

2.6. Heat of Vaporization Data

There are few reported experimental values of the heat of vaporization (latent heat) for nitrogen. These data are summarized in Table 8.

2.7. Critical Point

The difficulties of experimental determination of the critical parameters are the cause of considerable differences among the results obtained by the various investigators. The critical density cannot be defined accurately by experiment because of the infinite compressibility at the critical point and the associated difficulty of reaching thermodynamic equilibrium. Therefore, reported values for the critical density are generally calculated either by extrapolation of rectilinear diameters utilizing measured saturation densities, or by correlating single-phase data close to the critical point. Recent reported temperature, pressure, and density measurements for the critical point of nitrogen are listed in Table 9.

The critical parameters given by Zozulya and Blagoi[55]

Table 1. Summary of experimental P-ρ-T data for nitrogen

Source	Year	Number of data points	Pressure range (MPa)	Temperature range (K)	Uncertainty in pressure	Uncertainty in density	Uncertainty in temperature (K)	Purity of sample (percent)
Amagat[9]	1880	72	10-100	273-473				
Amagat[10]	1888	75	10-300	273-317				
Holborn & Otto[11]	1922	32	2-10	273-373	(0.2)[a]	(0.1)		
Smith & Taylor[12]	1923	40	3-32	273-473				
Holborn & Otto[13]	1924	66	2.4-10	273-673	(0.2)	(0.1)		
Holborn & Otto[14]	1924	24	2-10	143-273	(0.2)	(0.25)		
Kamerlingh Onnes & van Urk[15]	1924	143	2.3-6.3	124-293	(0.5)	(0.2)	(0.01)	
Bridgman[16]	1924	14	245-1470	341				99.6
Verschoyle[17]	1926	36	2.5-20	273-293	0.1	0.06	0.02	
Bartlett[18]	1927	9	.1-100	273				99.8
Bartlett et al.[19]	1928	46	5-100	273-673	0.1			
Heuse & Otto[20]	1929	8	.04-1	273	(1)	(1)	(0.01)	
Bartlett et al.[21]	1930	42	7.5-100	203-293	0.1	0.2	0.1	99.91
Basset & Dupinay[22]	1930	8	1001-5001	273-289				
Otto et al.[23]	1934	63	4.5-40	273-423	(0.5)	(0.005)	(0.01)	
Michels et al.[24]	1934	56	2-8	273-423	(0.2)	0.01	0.01	
Bridgman[25]	1935	25	301-601	133-296				99.9
Michels et al.[26]	1936	147	20-300	273-423	(0.2)	0.01 for P<1000 0.1 for P>1000	0.01	
Benedict[27]	1937	25	10-156	90-273	0.1	0.3	0.2	99.8
Benedict[28]	1937	124	98-588	98-473	0.3	0.3	0.1	
Maron & Turnbull[29]	1942	8	10-100	273				
Friedman[30]	1950	201	.02-20	80-300	(0.2)[a]	(0.5)	0.01	
Tsiklis[31]	1951	45	300-1000	323-423	.2 MPa	1.0	(0.5)	
Grilly & Mills[32]	1955	10	7-35	64-120				99.99
Townsend[33]	1956	35	.2-14	298-323	1.0 mm Hg			
Saurel[34]	1958	87	10-100	423-1273	(0.2)	(0.3)	(0.01)	
Van Itterbeek & Verbeke[35]	1960	67	1.3-14	66-91	(0.2)	(0.2)	(0.001)	
Miller et al.[36]	1960	10	.9-26	294	0.01 psi	0.1	0.03	99.9
Van Itterbeek & Verbeke[37]	1961	13	8-80	77-90	(0.2)	(0.2)	(0.001)	
Canfield et al.[38]	1962	9	5-40	143-273	0.01		0.01	99.995
Canfield et al.[39]	1962	152	.2-54	133-273	0.01	0.15	0.01	99.995
Golubev & Dobrovol'skii[40]	1965	59	5-48	77-133	(0.01)[a]	(0.05)	0.01	99.995
Crain[41]	1965	90	.2-50	143-273	(0.2)	(0.05)	(0.001)	
Streett & Staveley[42]	1967	107	.4-68	77-120	0.1	0.5)	0.01	
Cockett et al.[43]	1968	63	2.5-20	85-120	0.1	0.1 for T>107 .25 for T<107	0.001	99.999
Tsiklis & Polyakov[44]	1968	69	150-1000	294-673	.2 MPa	(0.3)	0.5	99.5
Robertson & Babb[45]	1969	170	150-1000	308-673	.5 MPa	0.05	(0.001)	99.95
Gibbons[46]	1969	17	2-13	72-78	(0.03)	0.15	0.03	99.99
Malbrunot & Vodar[47]	1969	63	100-400	473-1274	(0.2)	(0.3)	(0.001)	
Malbrunot[48]	1970	191	79-500	473-1274	(0.2)	(0.3)	(0.001)	
Hall & Canfield[49]	1970	18	.2-1.7	103-113	(0.2)		0.001	
Weber[50]	1970	76	14-266	80-140	0.01	0.15	0.01	
Cheng[51]	1972	420	22-1025	87-309	(0.1)	0.2	(0.001)	
Roe[52]	1972	80	.02-10.5	156-291	0.01	0.02	0.005	
Rodosevich & Miller[53]	1973	4	0.4-2	91-115	0.01		0.03	99.997
Rivkin[54]	1975	43	0.4-10	273-473	(0.02)[a]	(0.05)	(0.001)	
Zozulya & Blagoi[55]	1975	570	2.3-7.5	120-150	2×10^{-6} MPa	0.06	0.005	99.97
Liebenberg[56]	1975	520	70-2000	247-321	(0.3)	(0.2)	(0.05)	
Antanovich & Plotnikov[57]	1976	49	100-800	400-1800				
Da Ponte et al.[58]	1978	27	0.05-0.1	110-120	0.1	(0.1)	(0.001)	99.99
Younglove & McCarty[59]	1979	236	0.03-1.5	80-350	0.3		0.005	99.999
Straty & Diller[60]	1980	280	0.0-35.0	84-300	0.15	0.1	(0.001)	99.999
Morris & Wylie[61]	1983	48	197-560	253-308	0.034	0.019	0.005	99.996

[a] Numbers in parenthesis indicate uncertainty assigned in this work for calculation of weights using the error propagation formula.

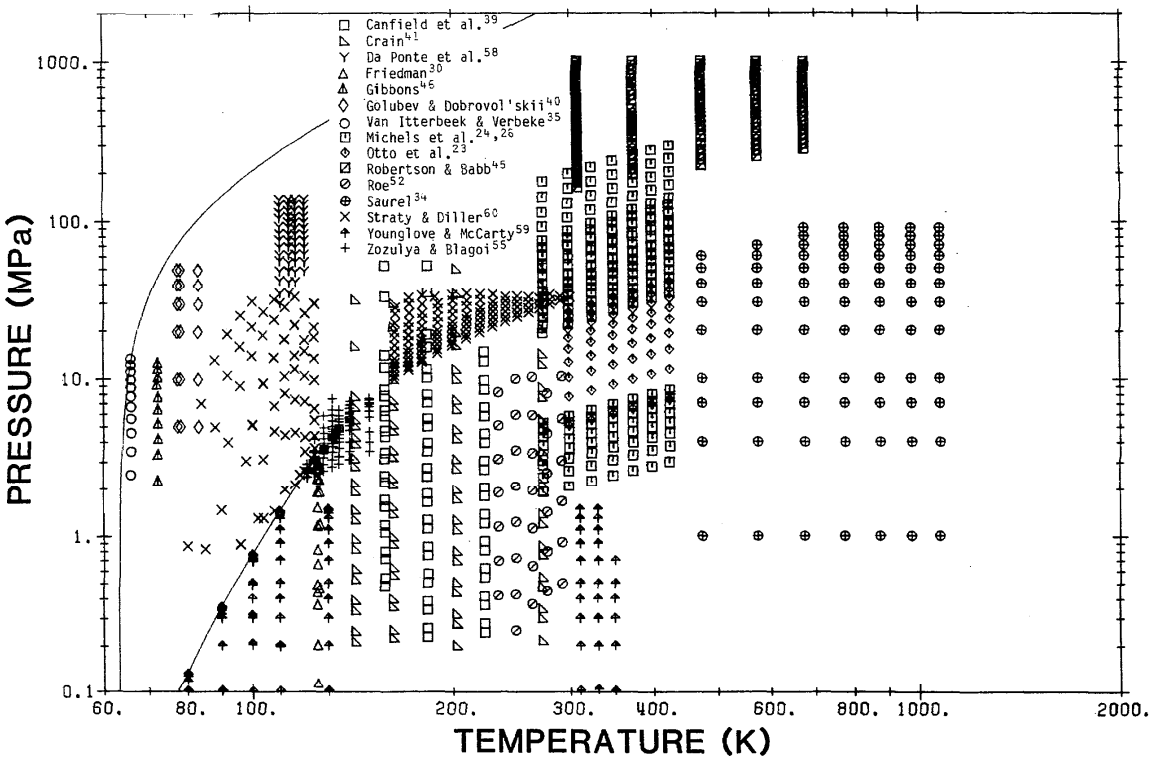

FIG. 1. Nitrogen P-ρ-T data (part 1, selected data).

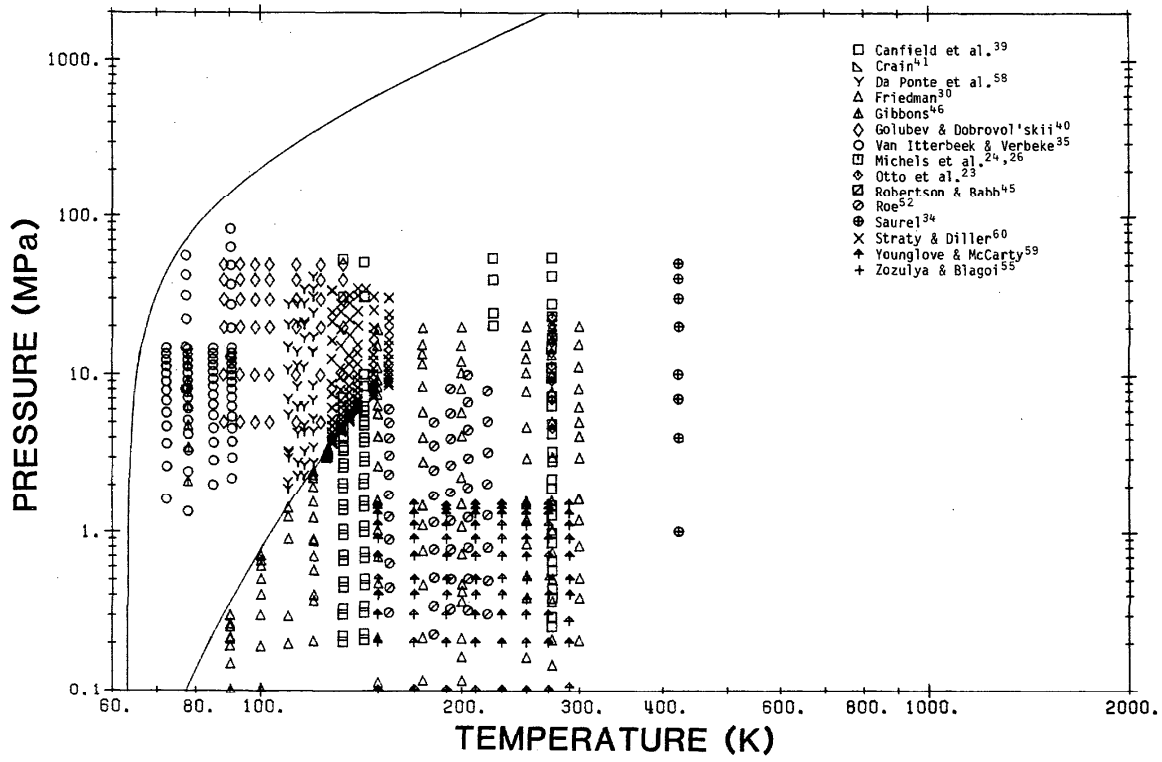

FIG. 2. Nitrogen P-ρ-T data (part 2, data not selected from same sources as Fig. 1).

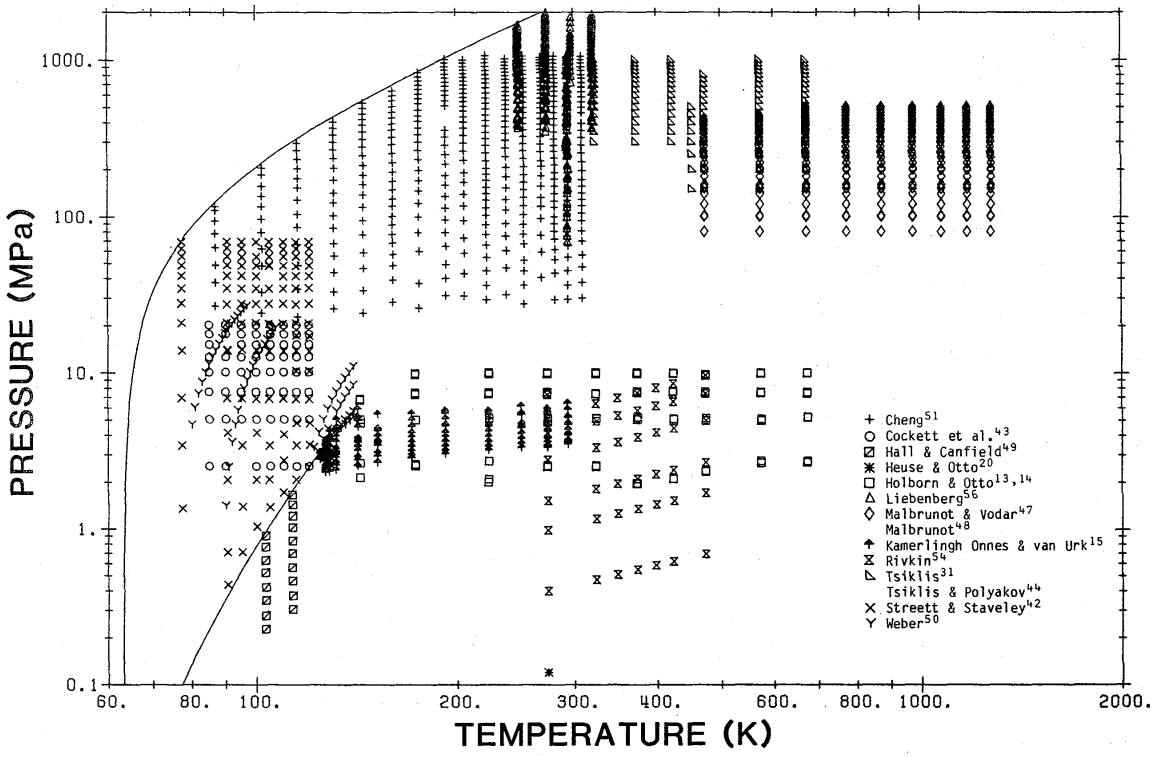

FIG. 3. Nitrogen P-ρ-T data (part 3, data not selected).

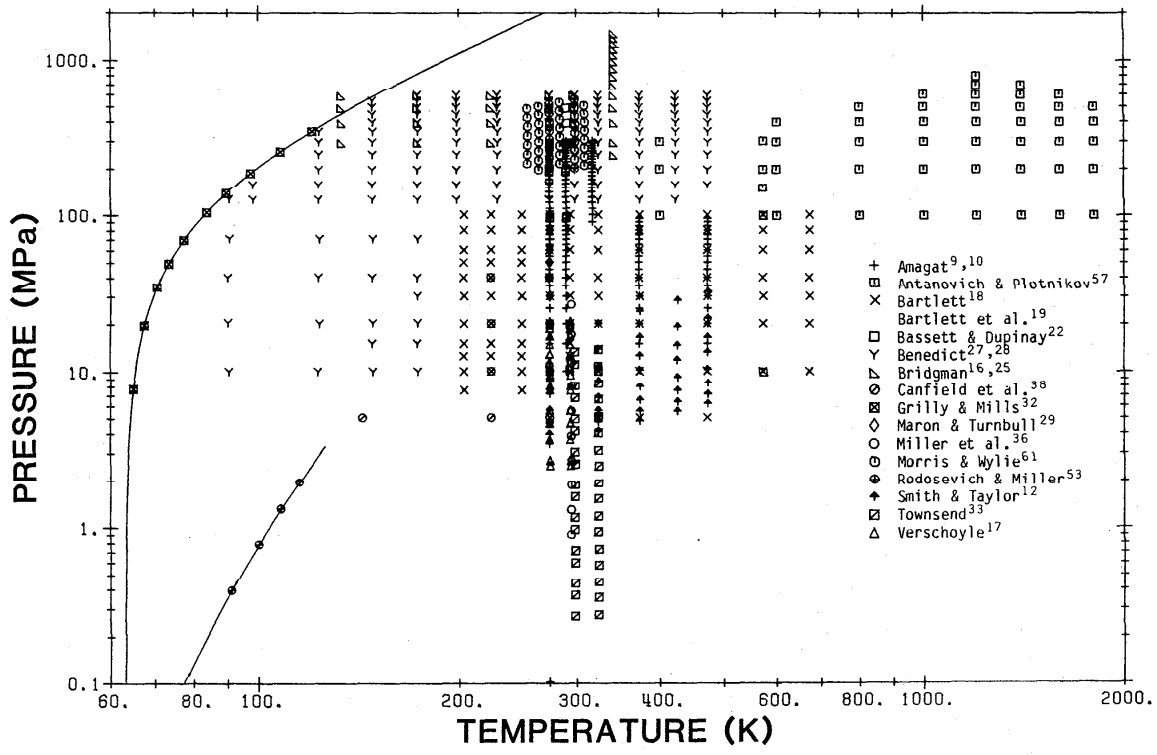

FIG. 4. Nitrogen P-ρ-T data (part 4, data not selected).

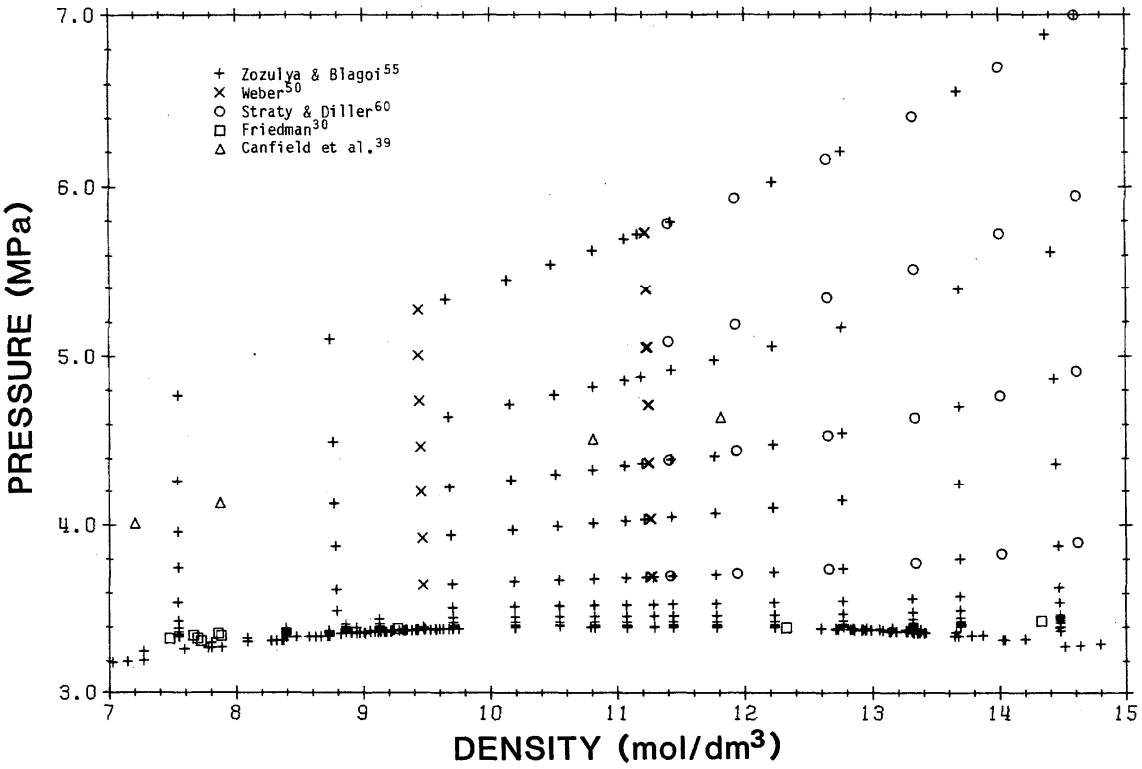

FIG. 5. Nitrogen P-ρ-T data (part 5, the critical region).

Table 2. Summary of experimental isochoric heat capacity data for nitrogen

Source	Year	Number of data points	Density range (mol/dm³)	Temperature range (K)	Uncertainty in C_V (percent)	Uncertainty in temperature (K)	Uncertainty in density	Purity of sample (percent)
Lestz[93]	1963	15[a]	0.1-1.2	273-303				99.95
Chashkin et al.[94]	1965		11.1	123-129				99.8
Voronel et al.[83]	1965	69	11.177	105-167	5	0.0002	0.01	99.98
Weber[95]	1981	104[b]	8.2-27.5	78-250	0.3-0.6	0.001-0.005		99.999

[a] Derived from velocity of sound data.

[b] Including 43 points on saturation line between 78 and 125 K.

Table 3. Summary of experimental isobaric heat capacity data for nitrogen

Source	Year	No. of data points	Pressure range (MPa)	Temperature range (K)	Purity of sample (percent)
Krase & Mackey[96]	1930	45	0-70	303-423	
Mackey & Krase[97]	1930	46	0.1-81	303-423	99
Workman[98]	1931	14	1-12.7	299-333	99.5
Giauque & Clayton[72]	1933	31		15-77	99.997
Bloomer & Rao[99]	1953	9	2-8	172-228	
Faulkner[100]	1959	9	2-8	172-228	
Lestz[93]	1963	15[a]	0.1-1.2	273-303	99.95
Mage et al.[75]	1963	37	1-13	117-274	
Van Kasteren & Zeldenrust[64]	1979	33	5.07	100-270	

[a] Derived from velocity of sound data.

Table 4. Summary of experimental heat capacity data of saturated liquid for nitrogen

Source	Year	No. of data points	Temperature range (K)
Eucken[74]	1916	5	64-73
Clusius[101]	1929	5	66-74
Wiebe & Brevoort[102]	1930	14	80-117
Keesom & Kamerlingh Onnes[103a]	1930	5	64-76
Giauque & Clayton[72]	1933	7	65-78

[a] Private communication to Wiebe & Brevoort[102].

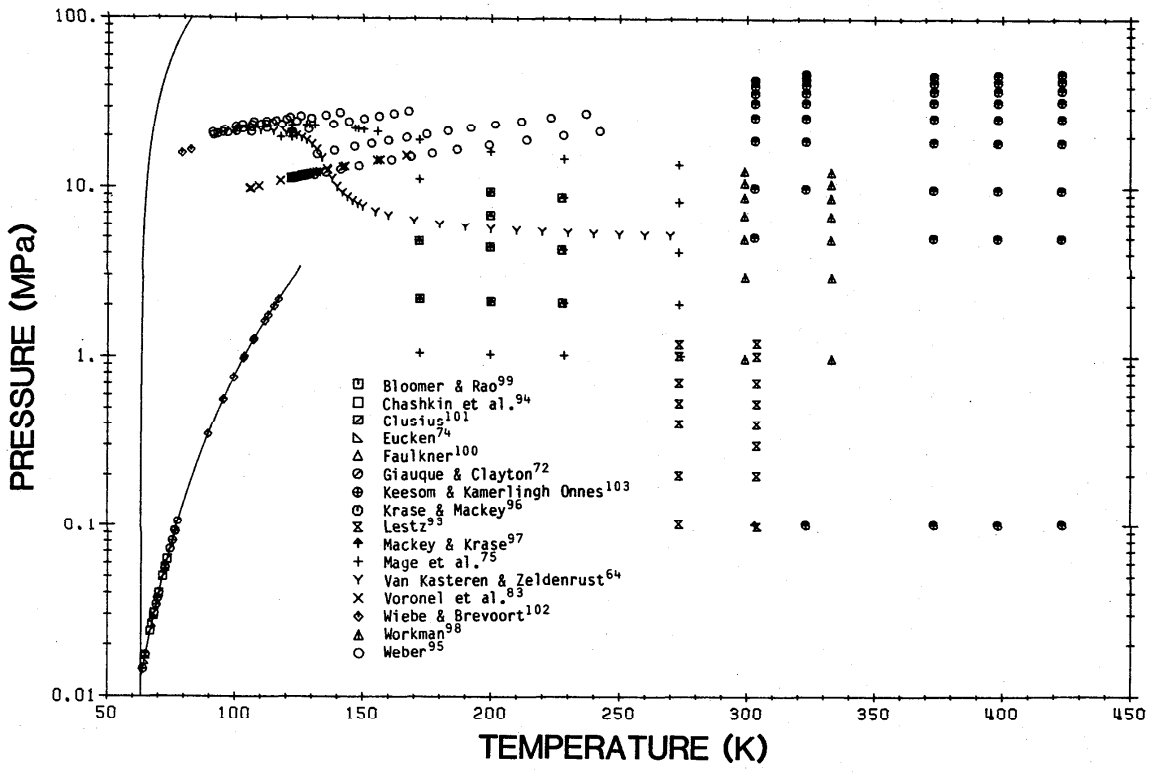

FIG. 6. Nitrogen heat capacity data.

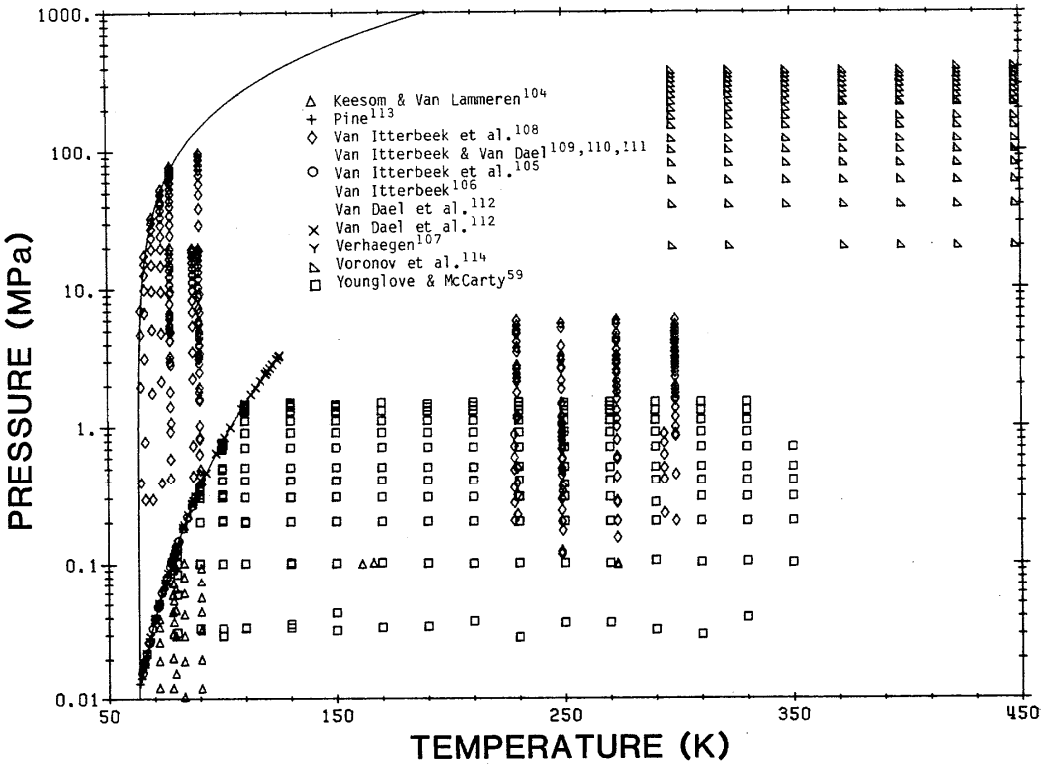

FIG. 7. Nitrogen velocity of sound data.

Table 5. Summary of experimental velocity of sound data for nitrogen

Source	Year	Number of data points	Pressure range (MPa)	Temperature range (K)	Uncertainty in W	Uncertainty in temperature (K)	Purity of sample (percent)
Keesom & Van Lammeren[104]	1937	42	0.01-0.1	72-273		0.5	
Van Itterbeek et al.[105]	1949	8		64-78	0.2	0.4	
Van Itterbeek[106]	1960	4	0.05-0.12	71-79			
Verhaegen et al.[107]	1952	12	0.01-0.1	64-77	±0.16	0.5	
Van Itterbeek et al.[108]	1957	122	0.2-5	227-298			
Van Itterbeek & Van Dael[109]	1958	29	0.4-5.6	77-90			
Van Itterbeek & Van Dael[110]	1961	44	0.4-20	83-90	1		
Van Itterbeek & Van Dael[111]	1962	76	0.3-77	64-91			99.8
Van Dael et al.[112]	1966	37	0.018-3.3	65-125	0.3	0.5	99.85
Pine[113]	1969	17	0.01-0.1	63-77	0.1	0.4	
Voronov et al.[114]	1969	113	20-405	298-448	0.3	0.05	
Younglove & McCarty[59]	1980	255	0.02-1.6	80-350	0.03	0.005-0.05	99.99988

Table 6. Summary of virial coefficients for nitrogen

Source	Year	Number of values	Temperature range (K)	Virial coefficient[a]
Holborn & Otto[11]	1922	3	273-373	B,C
Holborn & Otto[14]	1924	3	143-223	B,C,D
Holborn & Otto[13]	1924	7	273-673	B,c
Kamerlingh Onnes & van Urk[15]	1924	12	123-293	B
Verschoyle[17]	1924	2	273-293	B,C
Michels et al.[24]	1934	7	273-423	B,C
Michels et al.[26]	1936	7	273-373	B,C
Friedman[30]	1950	12	80-300	B,C
Bird et al.[116]	1950	2	273	B
Michels et al.[117]	1951	2	273	B
White[118]	1952	2	273	B
Van Itterbeek et al.[108]	1957	9	70-150	B
Saurel[34]	1958	8	423-1073	B,C,D
Pool et al.[119]	1962	1	90	B
Canfield et al.[38]	1962	5	133-273	B,C
Witonsky & Miller[120]	1963	5	448-748	B
Hoover et al.[121]	1964	6	133-273	B,C
Crain & Sonntag[122]	1966	4	143-273	B,C
Roe[52]	1972	13	155-291	B,C
Levelt Sengers et al.[123]	1972	50	100-1400	B

[a] B = second virial coef. C = third virial coef. D = fourth virial coef.

Table 7. Summary of enthalpy data for nitrogen

Source	Year	Number of data points	Temperature range (K)	Pressure range (MPa)
Wiener[62]	1966	17	138-450	4.7-6.7
Dawe & Snowdon[63]	1974	60	273-358	.1-10
Van Kasteren & Zeldenrust[64]	1979	33	100-270	.5
Clark & Piacentini[65]	1967	88	69-313	.01-2.5
Sahgal et al.[66]	1964	12	313-383	.8-10

Table 8. Summary of heat of vaporization data for nitrogen

Source	Year	Number of data points	Temperature range (K)	Pressure range (MPa)
Furukawa & McCoskey[67]	1953	6	67.96-78.02	0.28-1.08
Jones[68]	1961	5	119.16-124.29	23.80-30.61
Dana[69]	1925	1	77	1
Rodebush et al.[70]	1925	4	99-124.5	
Mathias et al.[71]	1923	11	64-125	
Giauque & Clayton[72]	1933	6	77	1
Clark & McKinley[73]	1969	1	122	27
Eucken[74]	1916	1	77	1
Mage et al.[75]	1963	5	119-124	23-30

Table 9. Critical-point parameters for nitrogen

Source	Year	Critical temperature (K)	Critical pressure (MPa))	Critical density (mol/dm^3)
Cardoso[76]	1915	128.45	3.410	
Din[77]	1961	126.2	3.39	11.1004
Kobe & Lynn[78]	1953	126.15	3.39	11.10
Mathews[79]	1972	126.15	3.39	11.17
Mathias et al.[80]	1914			11.10±0.01
Kamerlingh Onnes et al.[81]	1914	126.02±0.05	3.3934±0.005	
Sengers et al.[82]	1976	126.24	3.398	11.205
Voronel et al.[83]	1966	126.191-126.197		
Wagner[84]	1973	126.200	3.4002	
White et al.[85]	1951	126.242±0.04	3.398±0.002	
Zozulya & Blagoi[55]	1975	126.193±0.003[a]	3.3978	11.177±0.01

[a]Converted to IPTS-68 from published values of 126.206 K on IPTS-48.

Table 10. Measurements of the triple-point pressure for nitrogen

Source	Year	Pressure (MPa)
Verschoyle[17]	1926	0.012479
Justi[87]	1931	0.012520
Giauque & Clayton[72]	1933	0.012534
Henning & Otto[88]	1936	0.01261
Keesom & Bijl[89]	1937	0.012534
Kirschenbaum & Urey[90]	1942	0.012514
Clusius & Schleich[91]	1958	0.012534
Moussa et al.[92]	1966	0.012520
Wagner[84]	1973	0.01252

are consistent with the single-phase P-ρ-T data in the critical region. These values were used in the development of the fundamental equation in this work and for the revised and extended scaling equation of Jahangiri and Jacobsen.[7]

2.8. Triple Point

The triple point temperature for nitrogen is a secondary reference point of the International Practical Temperature Scale of 1968 (IPTS-68) with a value of 63.148 K.[86] Sources of triple point pressure for nitrogen are listed in Table 10. The selected temperature and pressure for the triple point in this work are 63.148 K and 0.012 53 ± 0.000 01 MPa, respectively.

3. Liquid–Vapor and Solid–Liquid Coexistence Properties

A new vapor pressure equation and equations for the density of the saturated liquid and the saturated vapor as functions of temperature have been developed to include the critical-region data. The functional forms for the ancillary equations reported here are similar to those reported by Wagner and Ewers[124] and by Pentermann and Wagner.[125]

3.1. The Vapor Pressure Equation

The functional form for the vapor pressure equation is

$$P/P_c = (T/T_c)\left(1 + N_1\tau + N_2\tau^{1.9} + N_3\tau^2 + N_4\tau^{2.4} + N_5\tau^3 + \sum_{i=6}^{17} N_i\tau^{(i+1)/2}\right), \quad (3.1)$$

Table 11. Summary of vapor pressure data for nitrogen

Source	Year	Number of data points	Temperature range (K)	Uncertainty in temperature (K)	Uncertainty in pressure	Temperature scale	Purity of sample (percent)
Crommelin[126]	1915	9	87-130				
Cath[127]	1918	8	64-85	0.01			
Porter & Perry[128]	1926	12	90-121				
Dodge & Davis[129]	1927	30	76-122	0.03			
Giauque & Clayton[72]	1933	19	54-78	0.001	66.66 x 10^{-6} MPa		
Keesom & Bijl[89]	1937	12	70-78			Leiden	
Friedman & White[130]	1950	20	77-126				99.86
Michels et al.[131]	1953	10	96-126			IPTS-48	
Armstrong[132]	1954	74	64-78		2 x 10^{-6} MPa	NBS-39	99.975
Moussa et al.[92]	1966	32	63-78	0.001	2.67 x 10^{-6} MPa	NBS-55	
Weber[50]	1970	47	65-126	0.001	1.5 x 10^{-4} MPa	IPTS-68	
Wagner[84]	1973	68	63-127	0.005	1 x 10^{-2}	IPTS-68	
Zozulya[133]	1975	28	84-127	0.0005	0.05	IPTS-48	99.97

Table 12. Coefficients for liquid-vapor coexistence property equations for nitrogen[a]

Vapor Pressure Equation (3.1)

N_1	= -5.072183802
N_2	= 0.1367990776 x 10^2
N_4	= -0.1194002133 x 10^2
N_6	= 2.641788411
N_{10}	= -0.3781265428
N_{13}	= 0.7593697713 x 10^{-1}

Saturated Liquid Density Equation (3.2)

N_1	= 0.1780437699 x 10^2
N_3	= 0.1202958313 x 10^4
N_4	= -0.4601087081 x 10^4
N_5	= 0.1051265347 x 10^5
N_6	= -0.1188582325 x 10^5
N_8	= 0.1740912806 x 10^5
N_9	= -0.1934202934 x 10^5
N_{10}	= 0.7191464655 x 10^4
N_{24}	= 0.8015275102
N_{25}	= -0.1895717510 x 10^3

Saturated Vapor Density Equation (3.3)

N_1	= 1.345167397
N_2	= 0.2721335451 x 10^2
N_3	= 0.1189562787 x 10^3
N_4	= -0.2681972897 x 10^3
N_5	= 0.3292110413 x 10^3
N_6	= -0.1381052419 x 10^3
N_{10}	= 0.3447426258 x 10^2
N_{24}	= -0.5724027229 x 10^2
N_{25}	= -1.592975033

[a]Coefficients not listed are zero.

where $\tau = [(T_c/T) - 1]$. P_c and T_c are the critical pressure and critical temperature, respectively. The values of P_c and T_c for nitrogen used for this equation are 3.3978 MPa and 126.193 K, respectively, from Zozulya and Blagoi.[55] Table 11 is a summary of available vapor pressure data for nitrogen.

Coefficients for Eq. (3.1) are given in Table 12. The data selected for the development of this equation were the data of Wagner[84] from 63 to 118 K and those of Zozulya[133] from 121 to 126.14 K. Comparisons of this equation to the vapor pressure data for nitrogen are given in Figs. 8–11.

3.2. The Equation for the Saturated Vapor Density

The functional form of the equation for the saturated vapor density is

$$\ln \frac{\rho''}{\rho_c} = \sum_{i=1}^{23} N_i \tau^{(i+1)/3} + N_{24} \ln \theta + N_{25} \tau^{0.325}, \quad (3.2)$$

where $\tau = [1 - (T/T_c)]$, $\theta = T_c/T$, and ρ'' is the density of the saturated vapor. The data used in the determination of the coefficients for Eq. (3.2) for temperatures between 103 and 120 K were obtained by the intersection of the vapor pressure Eq. (3.1) and a fundamental equation representing selected vapor phase data. This equation of state for nitrogen vapor is discussed in Jacobsen *et al.*[143] Also, saturated vapor density values calculated from the virial surface of Younglove and McCarty[59] were used for states at temperatures

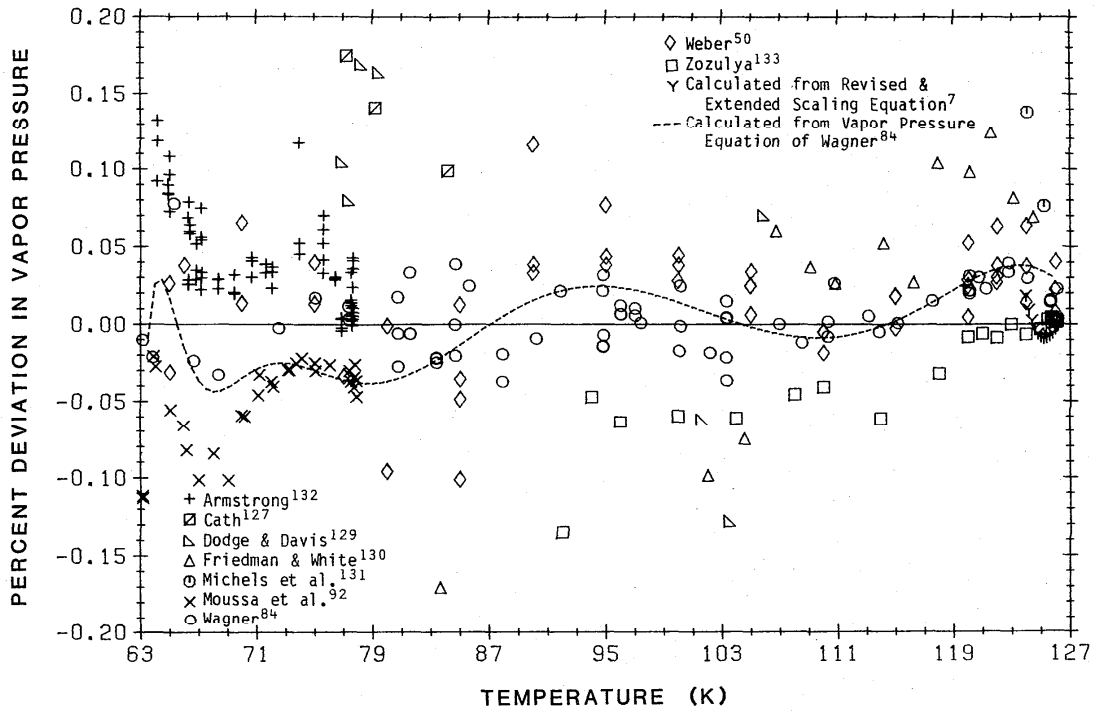

FIG. 8. Comparisons of vapor pressure values calculated from Eq. (3.1) to data.

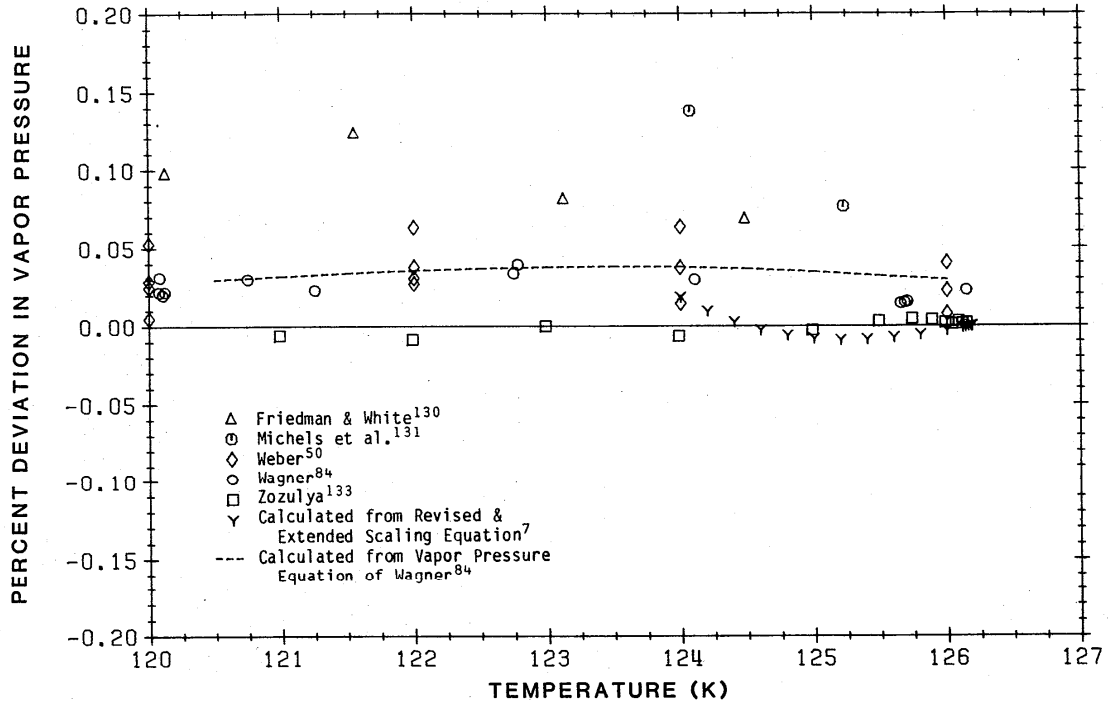

FIG. 9. Comparisons of vapor pressure values calculated from Eq. (3.1) to data near the critical point.

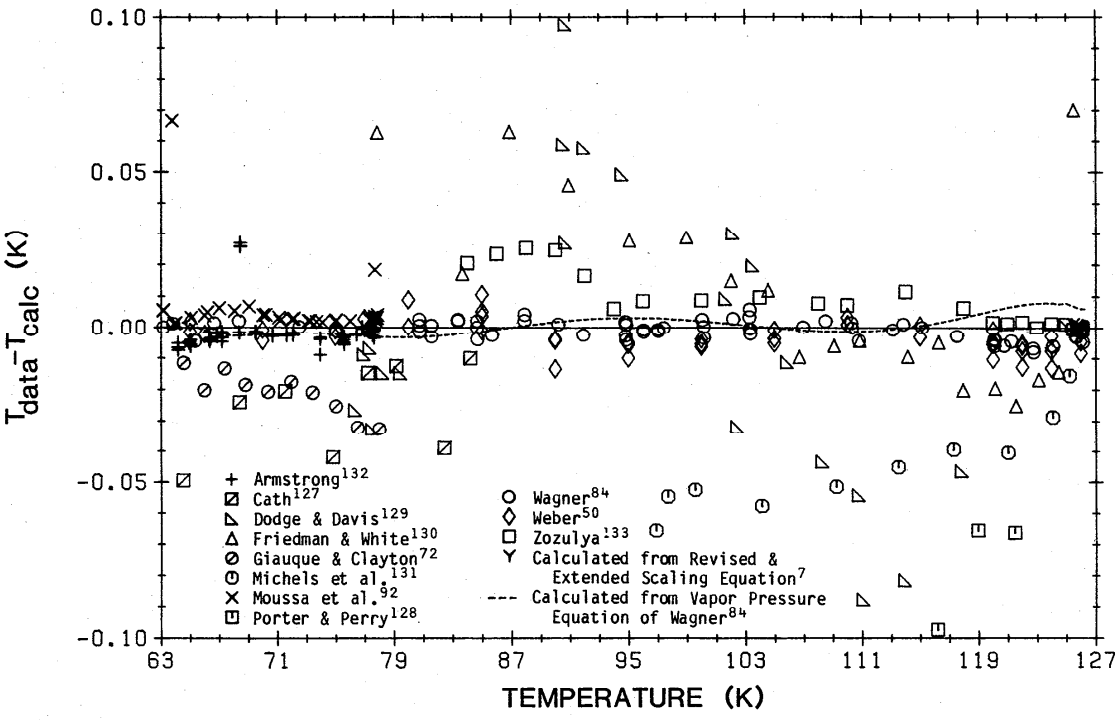

FIG. 10. Comparisons of saturation temperature calculated from Eq. (3.1) to data.

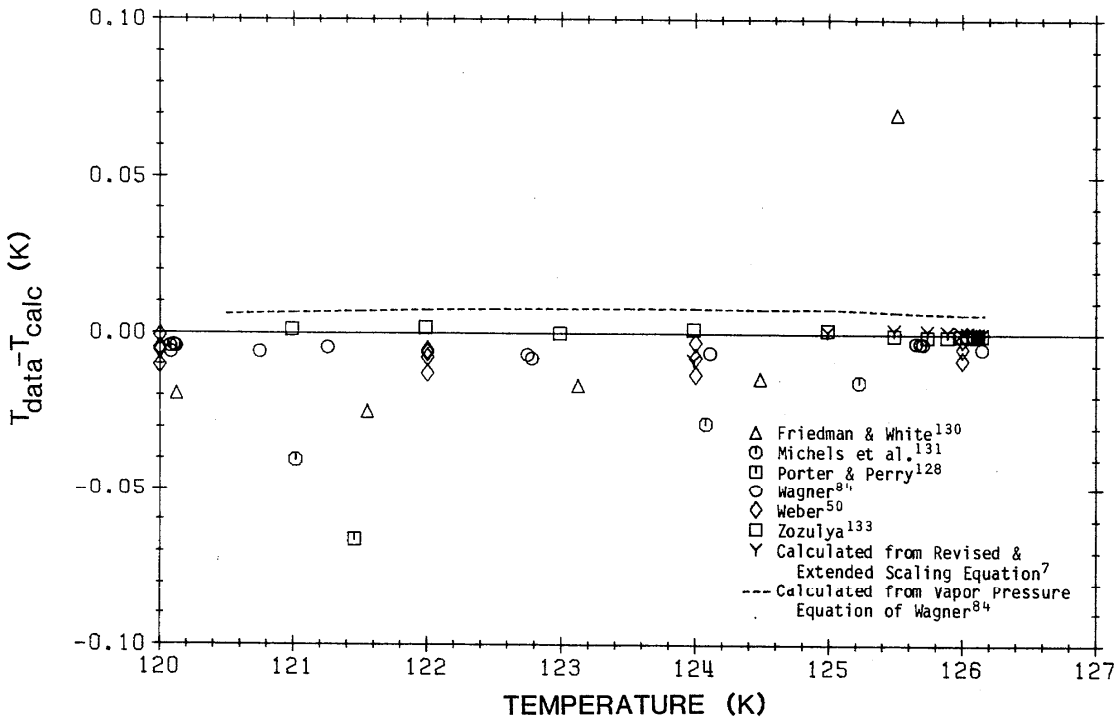

FIG. 11. Comparisons of saturation temperature calculated from Eq. (3.1) to data near the critical point.

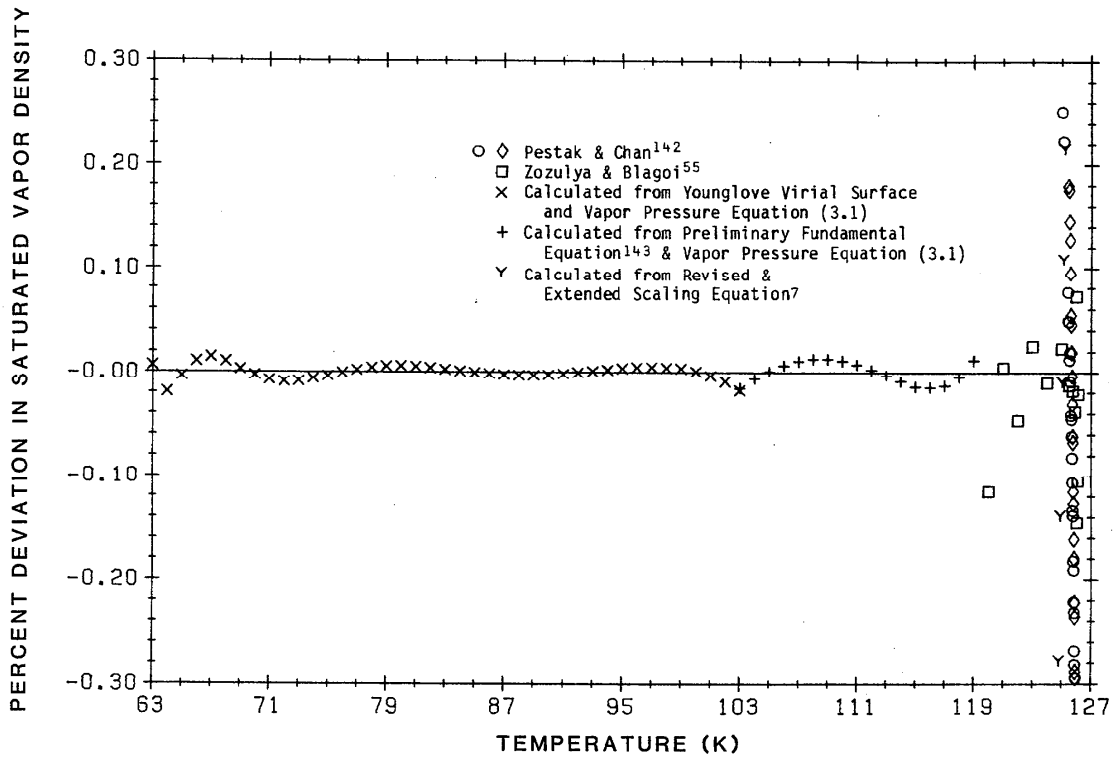

FIG. 12. Comparisons of saturated vapor density values calculated from Eq. (3.2) to data.

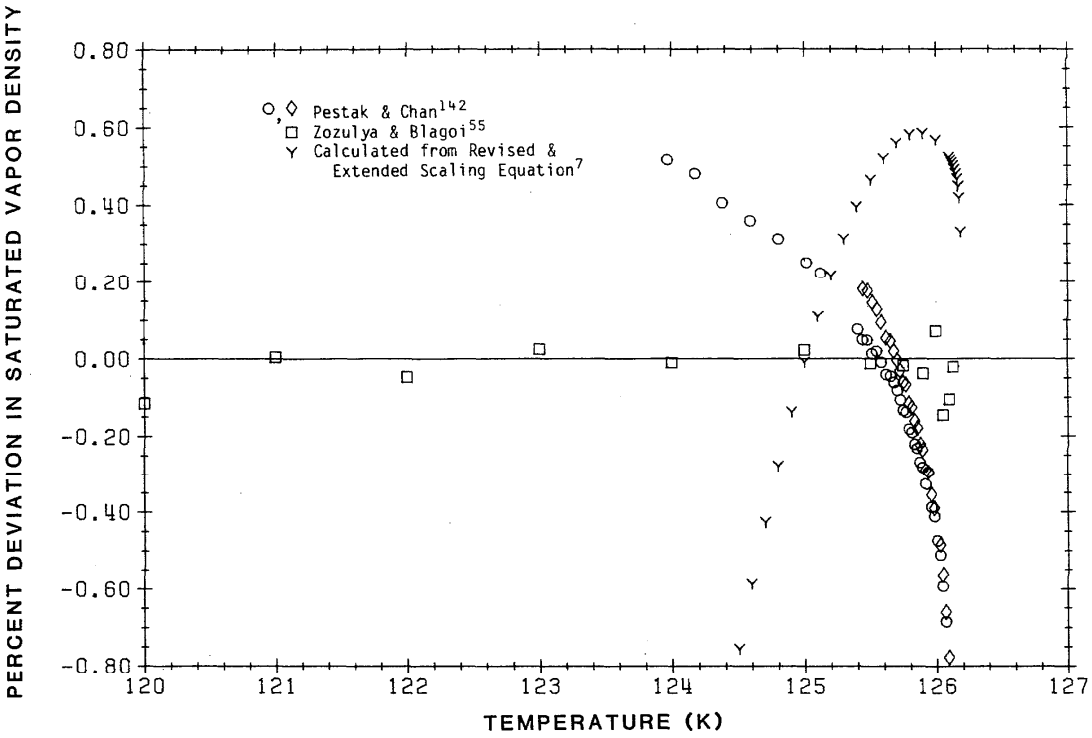

FIG. 13. Comparisons of saturated vapor density values calculated from Eq. (3.2) to data near the critical point.

Table 13. Summary of saturated liquid density data for nitrogen

Source	Year	Number of data points	Temperature range (K)	Uncertainty in temperature (K)	Uncertainty in density	Temperature scale	Purity of sample (percent)
Inglis & Coates[135]	1906	2	74-80				
Van Itterbeek & Verbeke[35]	1960	9	74-90				
Cockett et al.[43]	1968	10	80-125				99.998
Goldman & Scrase[136]	1968	30	78-126	0.01	0.175		99.8281
Terry et al.[137]	1969	15	78-105		0.1		99.99
Brauns[138]	1972	49	66-111		4×10^{-2}		99.998
Rodosevich & Miller[53]	1973	4	91-115	0.02	0.01	IPTS-68	99.997
Ely & Straty[134]	1974	19	63-127				
Zozulya & Blagoi[55]	1975	16	120-126	0.0005	0.06	IPTS-48	99.97
Haynes et al.[139]	1976	19	95-120	0.03	0.05	IPTS-68	99.99
Orrit & Laupretre[140]	1978	19	78-112	0.01	0.03 mol/dm^3		
Straty & Diller[60]	1979	9	80-120		0.1	IPTS-68	99.999
Albuquerque et al.[141]	1980	6	93-120		0.1	NBS	

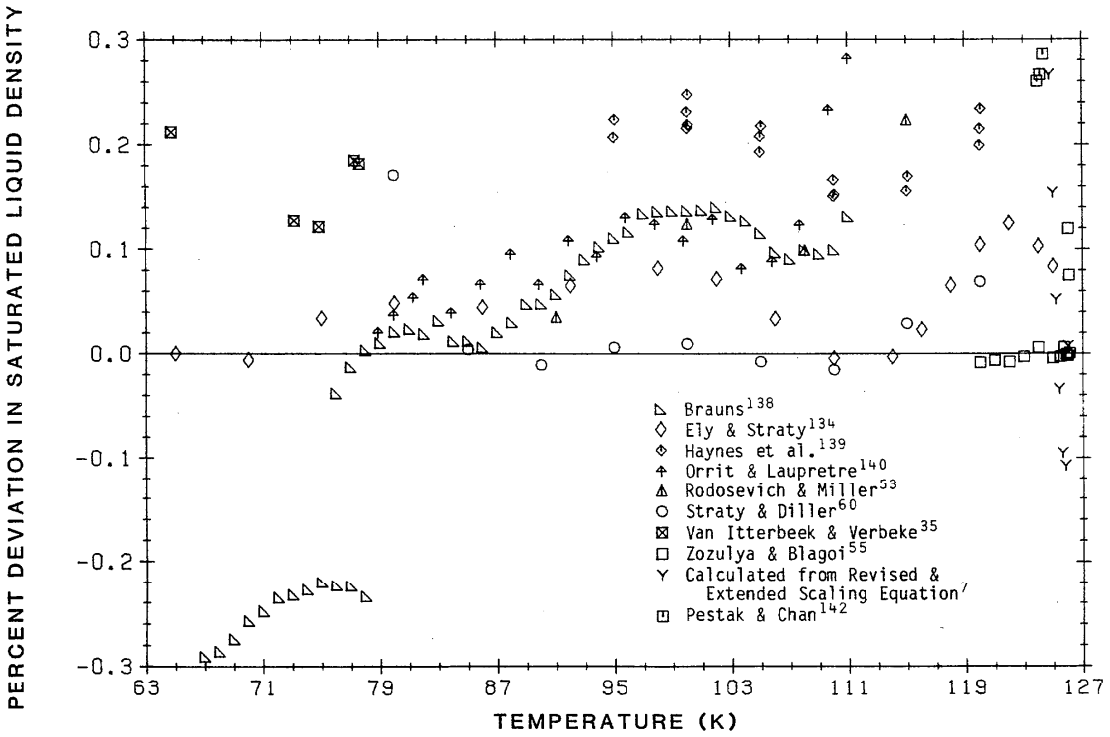

FIG. 14. Comparisons of saturated liquid density values calculated from Eq. (3.3) to data.

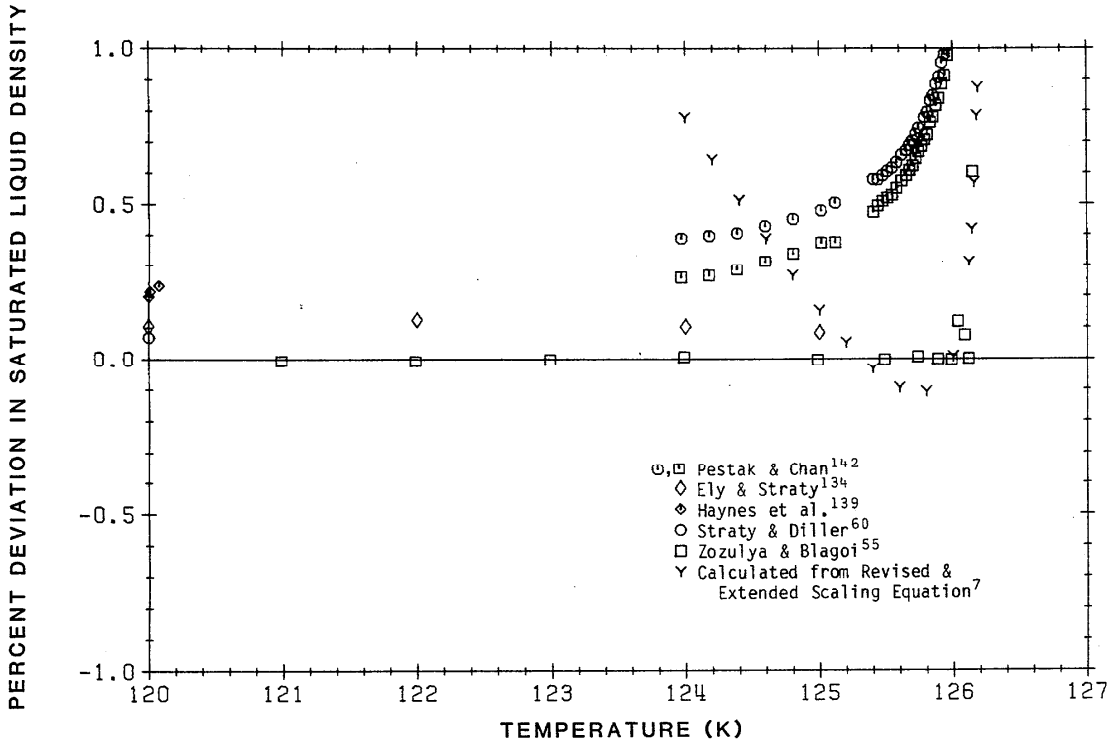

FIG. 15. Comparisons of saturated liquid density values calculated from Eq. (3.3) to data near the critical point.

from 63 to 103 K, and the data of Zozulya and Blagoi[55] were used from 121 to 126.13 K.

The coefficients for Eq. (3.2) are given in Table 12. The deviations of this equation from data are illustrated in Figs. 12 and 13.

3.3. The Equation for the Saturated Liquid Density

The functional form of the equation for saturated liquid density for nitrogen is

$$\frac{\rho'}{\rho_c} - 1 = \sum_{i=1}^{23} N_i \tau^{(i+1)/3} + N_{24}\tau^{0.325} + N_{25}\ln(\theta), \tag{3.3}$$

where $\tau = [1 - (T/T_c)]$, $\theta = T_c/T$, ρ' is the density of the saturated liquid, and $\rho_c = 11.177$ mol/dm^3, the critical density from Zozulya and Blagoi.[55] Table 13 is a summary of saturated liquid density data for nitrogen. The data used in the determination of the coefficients for Eq. (3.3) are one point from Ely and Straty[134] near the triple point, the data of Straty and Diller[60] from 85 to 115 K, and the data of Zozulya and Blagoi[55] from 120 to 126.14 K. The coefficients for Eq. (3.3) are given in Table 12. Deviations of saturated liquid density values calculated using this equation from data values are given in Figs. 14 and 15.

3.4. The Melting Pressure Equation

Pressures on the melting curve in this work are determined from the melting curve equation given by Watson at the National Engineering Laboratory in Scotland in a private communication as reported by Angus *et al.*[2]

$$\ln\left(\frac{P}{P_t}\right) = \sum_{i=1}^{5} N_i \left(\frac{T}{T_t}\right) - 1^{i/10}. \tag{3.4}$$

The coefficients N_i are listed in Table 14. N_i, P_t, and T_t are the triple point temperature given by Watson as 0.012 53 MPa and 63.148 K, respectively.

Measurements of the liquid density on the melting curve were published in reports by Grilly and Mills[32] in 1957, whose measurements cover the range 65 K (7.78 MPa) to 120 K (348.3 MPa), and by Cheng[51] over the range 87 K (124 MPa) to 193 K (1020 MPa). Where these two sets of data overlap, they differ by about $\pm$ 0.2% in density.

Table 14. Coefficients of the melting pressure equation for nitrogen

N_1	-22.207134
N_2	114.63633
N_3	-155.53829
N_4	95.230366
N_5	-21.764068

Table 15. Coefficients for the ideal gas heat capacity Eq. (4.1) for nitrogen (from Angus et al.[2])

N_1	$-0.837079888737 \times 10^3$
N_2	$0.379147114487 \times 10^2$
N_3	-0.601737844275
N_4	0.350418363823×10
N_5	$-0.874955653028 \times 10^{-5}$
N_6	$0.148958507239 \times 10^{-7}$
N_7	$-0.256370354277 \times 10^{-11}$
N_8	0.100773735767×10
N_9	0.335340610×10^4

4. Ideal Gas Heat Capacity

In the calculation of thermodynamic properties of nitrogen, an equation for the ideal gas heat capacity, C_p°, is used in the calculation of real fluid enthalpy, entropy, heat capacities, and velocity of sound. The equation previously reported by Angus *et al.*[2] has been incorporated in the fundamental equation reported in this work. The equation form suggested by Barieau[144] was fitted to the data from Barieau and Tully[145] up to 500 K and from NBS Circular No. 564[146] from 50 to 2500 K. The data of Barieau and Tully[145] were given greater weight than those from NBS Circular No. 564[146] at temperatures below 500 K. The equation is

$$\frac{C_p^\circ}{R} = \frac{N_1}{T^3} + \frac{N_2}{T^2} + \frac{N_3}{T} + N_4 + N_5 T + N_6 T^2 + N_7 T^3 + \frac{N_8 U^2 e^U}{(e^U - 1)^2}, \tag{4.1}$$

where C_p° is the ideal gas heat capacity, T is the temperature in kelvins, and $U = N_9/T$. The coefficients for Eq. (4.1) are given in Table 15. As indicated in Angus *et al.*[2] from 50 to 1100 K, the maximum difference between values of C_p°/R given in either of the two data sources from those calculated using Eq. (4.1) is less than $\pm$ 0.000 15. At higher temperatures the difference increases to a maximum of $\pm$ 0.000 26 at 2500 K.

5. The Determination of the Fundamental Equation for Nitrogen

This work is a more accurate representation of the thermodynamic property data for nitrogen than the prior formulation by Jacobsen and Stewart[1] for states in the critical region. In the development of the new formulation, a new functional form for the fundamental equation and new techniques for correlation have been used which resulted in improvements in the representation of the thermodynamic surface. The new form of the equation of state includes terms suggested by Schmidt and Wagner.[147]

5.1. Stepwise Least-Squares Technique with Search Procedure

The correlation presented in this work was developed using a stepwise least-squares technique with a search and selection procedure that was introduced by Wagner[6] and modified for use on equations of state by de Reuck and Armstrong.[5] The selection procedure selects an optimum group of terms from a proposed bank of terms based on statistical evaluation of the significance of individual terms.

5.2. Preparation of Experimental Property Data for Nitrogen for Use in the Correlation

The units adopted for this work were (MPa) for pressure, (mol/dm^3) for density, (K, IPTS-68) for temperature, and (J) for energy. Units of the experimental data were converted as necessary from those of the original publications to these units. All temperatures were converted to the International Practical Temperature Scale of 1968 (IPTS-68), as suggested by Douglas.[148]

Each data point used in the least-squares determination of the coefficients of the equation of state was assigned a weighting factor based upon estimates of uncertainties of the variables reported by the experimenter. In most cases these estimated uncertainties were taken from assessments of the overall accuracy of the data sets. Where reliable estimates of uncertainties were not available, estimated accuracies were determined by comparison to a preliminary least-squares representation of the surface. The weights used in the fitting process were calculated using the error propagation formula (sometimes called the theorem of propagation of variance). The functions for weighting were calculated by making use of a preliminary formulation for the partial derivative functions required for estimating variances by the error propagation formula. The determination of estimated variances uses the standard approximations for simple functions given by Ku.[149] Further details of the method used for weighting data are given by Jacobsen[150] and Jahangiri.[151] In several instances the error propagation weights were modified by the assignment of arbitrary mutiplicative factors to increase or lessen the effect of a particular data set on the overall representation of the surface.

5.3. The Fundamental Equation

The Helmholtz energy is given by the fundamental equation

$$A(\rho,T) = A^\circ(\rho,T) + \overline{A}(\rho,T), \tag{5.1}$$

where $A^\circ(\rho,T)$ is the ideal gas contribution to the Helmholtz energy of any state. The term $\overline{A}(\rho,T)$ is the contribution represented by the compressibility of the real gas.

The pressure derived from this expression is

$$P = \rho^2 \left(\frac{\partial A}{\partial \rho}\right)_T. \tag{5.2}$$

The Helmholtz energy for the ideal gas is given by

$$A^\circ = H^\circ - RT - TS^\circ. \tag{5.3}$$

The ideal gas enthalpy is given by

$$H^\circ = H_0^\circ + \int_{T_0}^{T} C_p^\circ \, dT, \tag{5.4}$$

where $H_0^\circ = 8669$ J/mol is the datum value at $T_0 = 298.15$ K, based upon a zero reference point for the ideal crystal at absolute zero temperature. The ideal gas entropy is given by

$$S^\circ = S_0^\circ + \int_{T_0}^{T} \frac{C_p^\circ}{T} dT - R \ln\left(\frac{\rho T}{\rho_0 T_0}\right), \tag{5.5}$$

where $S_0^\circ = 191.502$ J/(mol K) is the datum value for entropy at $T_0 = 298.15$ K and $P_0 = 0.101\,325$ MPa, based upon a zero reference point of the ideal crystal at absolute zero temperature. The Helmholtz energy for the ideal gas is given by

$$A^\circ = H_0^\circ + \int_{T_0}^{T} C_p^\circ \, dT - RT - T\left[S_0^\circ + \int_{T_0}^{T} \frac{C_p}{T} dT - R \ln\left(\frac{\rho T}{\rho_0 T_0}\right)\right]. \tag{5.6}$$

The equation for the ideal gas heat capacity used with Eq. (5.6) to develop the complete expression for A° is given in Sec. 4.

The functional form used for the fundamental equation for nitrogen is a nondimensional potential function,

$$\alpha(\delta,\tau) = A(\rho,T)/(RT) = \alpha^\circ(\delta,\tau) + \overline{\alpha}(\delta,\tau), \tag{5.7}$$

$$\alpha^\circ = \frac{H_0^\circ \tau}{RT_c} - \frac{S_0^\circ}{R} - 1 + \ln\frac{\delta\tau_0}{\delta_0\tau} - \frac{\tau}{R}\int_{\tau_0}^{\tau} \frac{C_p^\circ}{\tau^2} d\tau + \frac{1}{R}\int_{\tau_0}^{\tau} \frac{C_p^\circ}{\tau} d\tau, \tag{5.8}$$

and where $\tau = T_c/T$, $\tau_0 = T_c/T_0$, $\delta = \rho/\rho_c$, $\delta_0 = \rho_0/\rho_c$, the

Table 16. Parameters considered in the determination of the equation of state for nitrogen

k	i	j	ℓ	k	i	j	ℓ	k	i	j	ℓ
1	1	0.25	0	35	4	5.00	0	68	2	20.00	6
2	1	0.50	0	36	6	1.00	0	69	2	24.00	6
3	1	0.75	0	37	6	2.00	0	70	2	28.00	6
4	1	1.00	0	38	6	3.00	0	71	2	32.00	6
5	1	1.25	0	39	6	4.00	0	72	3	8.00	3
6	1	1.50	0	40	6	5.00	0	73	3	10.00	3
7	1	1.75	0	41	6	6.00	0	74	3	12.00	3
8	1	2.00	0	42	1	3.00	3	75	3	14.00	3
9	1	2.50	0	43	1	4.00	3	76	3	16.00	3
10	1	3.00	0	44	1	5.00	3	77	3	18.00	3
11	1	4.00	0	45	1	6.00	3	78	3	20.00	3
12	1	5.00	0	46	1	7.00	3	79	3	22.00	3
13	1	6.00	0	47	1	8.00	3	80	4	4.00	2
14	1	7.00	0	48	1	9.00	3	81	4	5.00	2
15	2	0.25	0	49	1	10.00	3	82	4	6.00	2
16	2	0.50	0	50	2	1.00	2	83	4	7.00	2
17	2	0.75	0	51	2	2.00	2	84	4	8.00	2
18	2	1.00	0	52	2	3.00	2	85	4	9.00	2
19	2	1.50	0	53	2	4.00	2	86	4	10.00	2
20	2	2.00	0	54	2	5.00	2	87	4	10.00	4
21	2	2.50	0	55	2	7.00	2	88	4	12.00	4
22	2	3.00	0	56	2	8.00	2	89	4	14.00	4
23	2	3.50	0	57	2	8.00	4	90	4	16.00	4
24	3	0.25	0	58	2	10.00	4	91	4	18.00	4
25	3	0.50	0	59	2	12.00	4	92	4	20.00	4
26	3	0.75	0	60	2	14.00	4	93	4	22.00	4
27	3	1.00	0	61	2	16.00	4	94	4	24.00	4
28	3	1.50	0	62	2	18.00	4	95	8	4.00	2
29	3	2.00	0	63	2	20.00	4	96	8	5.00	2
30	3	2.50	0	64	2	22.00	4	97	8	6.00	2
31	4	1.00	0	65	2	8.00	6	98	8	7.00	2
32	4	2.00	0	66	2	12.00	6	99	8	8.00	2
33	4	3.00	0	67	2	16.00	6	100	8	9.00	2
34	4	4.00	0								

γ=0 for terms with ℓ=0,
γ=1 for terms with ℓ greater than 0.

reduced ideal gas density at P_0 and T_0, ρ_c is the critical density, T_c is the critical temperature, T_0 is the reference temperature 298.15 K, P_0 is the reference pressure 0.101 325 MPa, ρ_0 is the ideal gas density at T_0 and P_0, H_0° is the reference enthalpy at T_0, S_0° is the reference entropy at T_0 and P_0, and R is the gas constant 0.008 314 34 (MPa dm^3)/(mol K). The real fluid contribution to the dimensionless Helmholtz energy is given by

$$\bar{\alpha}(\delta,\tau) = \sum_{k=1}^{100} N_k \delta^i \tau^j \exp(-\gamma\delta^l), \tag{5.9}$$

where the N_k are the coefficients of the fundamental equation, and γ has a value of 0 or 1.

The values of i, j, and l are arbitrary. However, j is generally expected to be greater than zero, and i and l are integers greater than or equal to zero. The selection of values for nitrogen was based upon preliminary fits to selected data using different integers for i and l, and real values for j. The bank of terms used for nitrogen is given in Table 16.

The reduced fit variables used in the simultaneous fitting of multiple data forms are given in Table 17. These functions were used to represent the selected data for liquid and vapor phases by simultaneous least-squares fitting of various property data.

Data used in fitting the fundamental equation of state for nitrogen were selected to avoid redundancy in various regions of the surface. The experimental P-ρ-T data selected for this work are illustrated in Fig. 1. Also, smoothed values of the two-phase equilibrium properties calculated from Eqs. (3.1), (3.2), and (3.3) were included in the P-ρ-T data set. The experimental values for velocity of sound data are those of Younglove and McCarty,[59] Van Itterbeek and Van Dael,[111] and the saturated liquid values of Van Dael *et al.*[112] The coefficients of Eq. (5.9) given in Table 18 were determined by a least-squares fit to 2112 selected data points.

Table 17. Functions for fitting the fundamental equations of state to various data forms

Data form	Fit variable
P-ρ-T	$\frac{P}{P_c} - \frac{\delta}{\tau Z_c} = \frac{\delta^2}{\tau Z_c} \sum_{i=1}^{n} P_i(\delta,\tau)$
	where $P_i(\delta,\tau) = (\partial \bar{\alpha}_i/\partial\delta)_\tau$
C_v-ρ-T	$\frac{C_v}{R} + \tau^2 \frac{\partial^2 \alpha^0}{\partial \tau^2} = -\tau^2 \sum_{i=1}^{n} C_i(\delta,\tau)$
	where $C_i(\delta,\tau) = \left[\frac{\partial^2 \bar{\alpha}}{\partial \tau^2}\right]_\delta$
Saturated Liquid and Vapor Density Data	$\frac{P_\sigma}{P_c} - \frac{\delta_{SL}}{\tau_\sigma Z_c} = \frac{\delta^2_{SL}}{\tau_\sigma Z_c} \sum_{i=1}^{n} P_i(\delta_{SL},\tau_\sigma)$
	$\frac{P_\sigma}{P_c} - \frac{\delta_{SV}}{\tau_\sigma Z_c} = \frac{\delta^2_{SV}}{\tau_\sigma Z_c} \sum_{i=1}^{n} P_i(\delta_{SV},\tau_\sigma)$
Maxwell Criterion	$-(P_\sigma \rho_c / RT_\sigma)[(1/\delta_{SV}) - (1/\delta_{SL})]$
	$-\ln(\delta_{SV}/\delta_{SL}) = \bar{\alpha}_{SV} - \bar{\alpha}_{SL}$
Velocity of Sound	$\frac{W^2 \tau}{\gamma RT_c} - 1 = \sum_{i=1}^{n} \left[2\delta\left(\frac{\partial \bar{\alpha}}{\partial \delta}\right)_\tau + \delta^2 \left(\frac{\partial^2 \bar{\alpha}}{\partial \delta^2}\right)_\tau\right]$
Second Virial Coefficient	$B(\tau) = \sum_{i=1}^{n} B_i(\tau)$
	where $B_i(\tau) = \frac{1}{\rho_c}\left(\frac{\partial \bar{\alpha}}{\partial \delta}\right)_\tau \Big\vert_{\delta=0}$

Table 18. Coefficients for the fundamental equation (Eq. 5.9) for nitrogen[a] (coefficients not listed are zero.)

	i	j	ℓ
N_1 = 0.9499541827	1	0.25	0
N_4 = -2.049741504	1	1.00	0
N_6 = 0.2650110798	1	1.50	0
N_{10} = -0.3785445194	1	3.00	0
N_{15} = 0.24617105513	2	0.25	0
N_{16} = -0.1748429008	2	0.50	0
N_{20} = 0.07311459372	2	2.00	0
N_{22} = 0.1895290433	2	3.00	0
N_{24} = -0.2046287122	3	0.25	0
N_{25} = 0.6387017148	3	0.50	0
N_{26} = -0.5272986168	3	0.75	0
N_{31} = 0.05551383553	4	1.00	0
N_{32} = -0.0281308071	4	2.00	0
N_{33} = 0.007001895093	4	3.00	0
N_{36} = -0.0008191106396	6	1.00	0
N_{37} = 0.001659823569	6	2.00	0
N_{42} = -0.04927710927	1	3.00	3
N_{43} = 0.1138121942	1	4.00	3
N_{50} = 0.05032519699	2	1.00	2
N_{51} = 0.06012817812	2	2.00	2
N_{54} = -0.09551409802	2	5.00	2
N_{57} = -0.01100721771	2	8.00	4
N_{63} = -0.0001484600538	2	20.00	4
N_{79} = -0.005806483467	3	22.00	3
N_{80} = 0.06512013679	4	4.00	2
N_{82} = 0.02118354140	4	6.00	2
N_{89} = 0.01284432210	4	14.00	4
N_{91} = -0.01054474910	4	18.00	4

[a] γ = 0 for terms 2 through 41 and γ = 1 for terms 42 through 100.

5.4. Derived Thermodynamic Properties

The functions used for calculating pressure, compressibility factor, internal energy, enthalpy, entropy, isochoric heat capacity, isobaric heat capacity, Gibbs energy, and the velocity of sound from Eq. (5.7) are given as Eqs. (5.10)–(5.18).[a] These functions were used in calculating the tables of thermodynamic properties of nitrogen given in the Appendix.

The compressibility factor $Z = P/\rho RT$ is given by the equations

$$Z = \frac{P}{\rho RT} = 1 + \delta \frac{\partial \bar{\alpha}}{\partial \delta} \tag{5.10}$$

and

$$\frac{P}{P_c} = \frac{\delta}{\tau Z_c}\left(1 + \frac{\partial \bar{\alpha}}{\partial \delta}\right). \tag{5.11}$$

[a] In the expressions for derived properties Eqs. (5.10)–(5.18), the subscripts for the properties held constant during differentiation are omitted.

Similarly,

$$\frac{U}{RT} = \tau\left(\frac{\partial\alpha^\circ}{\partial\tau} + \frac{\partial\overline{\alpha}}{\partial\tau}\right), \tag{5.12}$$

$$\frac{S}{R} = \tau\left(\frac{\partial\alpha^\circ}{\partial\tau} + \frac{\partial\overline{\alpha}}{\partial\tau}\right) - \alpha^\circ - \overline{\alpha}, \tag{5.13}$$

$$\frac{H}{RT} = \tau\left(\frac{\partial\alpha^\circ}{\partial\tau} + \frac{\partial\overline{\alpha}}{\partial\tau}\right) + \delta\frac{\partial\overline{\alpha}}{\partial\delta} + 1, \tag{5.14}$$

$$\frac{G}{RT} = 1 + \alpha^\circ + \overline{\alpha} + \delta\left(\frac{\partial\alpha}{\partial\delta}\right), \tag{5.15}$$

$$\frac{C_v}{R} = -\tau^2\left(\frac{\partial^2\alpha^\circ}{\partial\tau^2} + \frac{\partial^2\overline{\alpha}}{\partial\tau^2}\right), \tag{5.16}$$

$$\frac{C_p}{R} = \frac{C_v}{R} + \left[\frac{1 + \delta\frac{\partial\overline{\alpha}}{\partial\delta} - \delta\tau\frac{\partial^2\overline{\alpha}}{\partial\delta\partial\tau}}{1 + 2\delta\frac{\partial\overline{\alpha}}{\partial\delta} + \delta^2\frac{\partial^2\overline{\alpha}}{\partial\delta^2}}\right]^2, \tag{5.17}$$

$$\frac{W^2}{RT} = 1 + 2\delta\frac{\partial\overline{\alpha}}{\partial\delta} + \delta^2\frac{\partial^2\overline{\alpha}}{\partial\delta^2} - \frac{\left[1 + \delta\frac{\partial\overline{\alpha}}{\partial\delta} - \delta\tau\frac{\partial^2\overline{\alpha}}{\partial\delta\partial\tau}\right]^2}{\left[\tau^2\frac{\partial^2\alpha^\circ}{\partial\tau^2} + \tau^2\frac{\partial^2\overline{\alpha}}{\partial\tau^2}\right]}. \tag{5.18}$$

Saturation entries in the isobar tables were calculated using temperatures determined from the vapor pressure equation. The densities for the saturated liquid and saturated vapor were calculated iteratively from the fundamental equation. The derived properties for saturation states were calculated as functions of temperature and density using standard thermodynamic relations. Table entries for the liquid–vapor saturation table were calculated using the vapor pressure equation to determine P_σ at the table value of T_σ. Densities and derived properties were calculated using the methods described above for saturation entries in the isobar tables.

6. Comparisons of the Fundamental Equation to Data

This section includes comparisons of properties calculated using the fundamental equation for nitrogen with experimental data including P-ρ-T data, C_v, C_p, C_σ, heat of vaporization, velocity of sound, second virial coefficients, coexistence property data, and enthalpy. Separate comparisons to P-ρ-T, C_v, and velocity of sound data in the critical region are given.

6.1. Comparisons of the Fundamental Equation to P-ρ-T Data

Comparisons of values of density calculated using the fundamental equation with selected experimental densities (including some values not used in the determination of the coefficients of the fundamental equation) are included in this section. The coordinates of the graphs were selected to illustrate the quality of the fit in four regions: (1) liquid and (2) vapor states at temperatures below the critical temperature, (3) states at the temperatures above the critical region boundary (140 K), and (4) states near the critical temperature. Data reported by experimenters on isotherms are illustrated on those isotherms. Other data including those reported on pseudo-isochores are grouped for arbitrary ranges of temperature. Deviations of data not included in graphical comparisons are summarized in Table 19.

Table 19. Summary comparisons to P-ρ-T data not included in graphical comparisons

Author	Temperature range (K)	Pressure range (MPa)	Maximum deviation in density (percent-absolute value)	Number of data points
Antanovich & Plotnikov[57]	400-1800	100-800	3.1	45
Basset & Dupinay[22]	273-289	98-490	34	10
Bridgman[25]	133-297	294-589	17	25
Bridgman[16]	341	245-1471	7.4	14
Maron & Turnbull[29]	273	10-82	1.5	8
Smith & Taylor[12]	273-473	1.9-29	1.9	36

6.1.1. Liquid Region

Figure 16 illustrates comparisons of density values calculated with the fundamental Eq. (5.7) with liquid P-ρ-T data of nitrogen. Data points below 124 K with deviations exceeding + 0.8% in density are noted on the graphs.

6.1.2. Vapor Region for Temperatures Below the Critical Temperature

Figure 17 illustrates comparisons of density values from the fundamental Eq. (5.7) with vapor data for nitrogen below 124 K. Calculated values agree with these data generally within 0.5% in density.

6.1.3. Fluid Region for Temperatures Above the Critical Temperature

Figure 18 illustrated comparisons of the data above the critical temperature with values from Eq. (5.7). These values generally agree within 0.5% in density.

6.1.4. Isotherms Near the Critical Temperature

Figure 19 illustrates comparisons of the calculated and measured density values in the temperature range of 124.6–140 K at densities between 0 and 40 mol/dm^3. These comparisons indicate agreement of calculated and experimental values generally within 2% in density. As shown in Fig. 19, there is good agreement of values calculated using Eq. (5.7) with the available data except in the range of 8–14 mol/dm^3. The predicted values at densities from 8 to 14 mol/dm^3 exhibit deviations as large as 2% in density from the data values. This behavior is expected for classical analytic equations of state in the critical region. A more detailed discussion of the behavior of Eq. (5.7) in the critical region is included in Sec. 6.9.

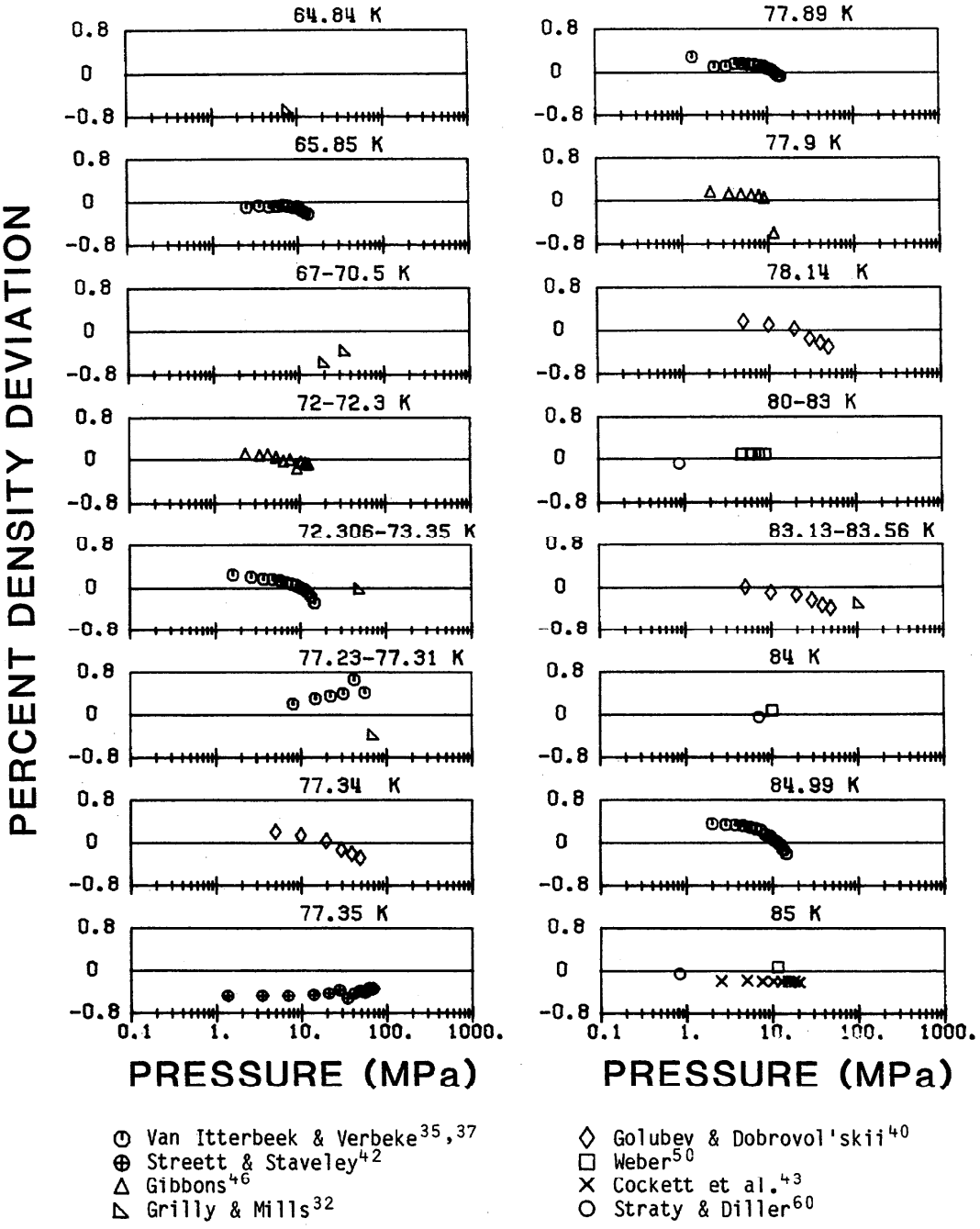

FIG. 16. Comparisons of calculated values of density to data for the liquid below the critical temperature.

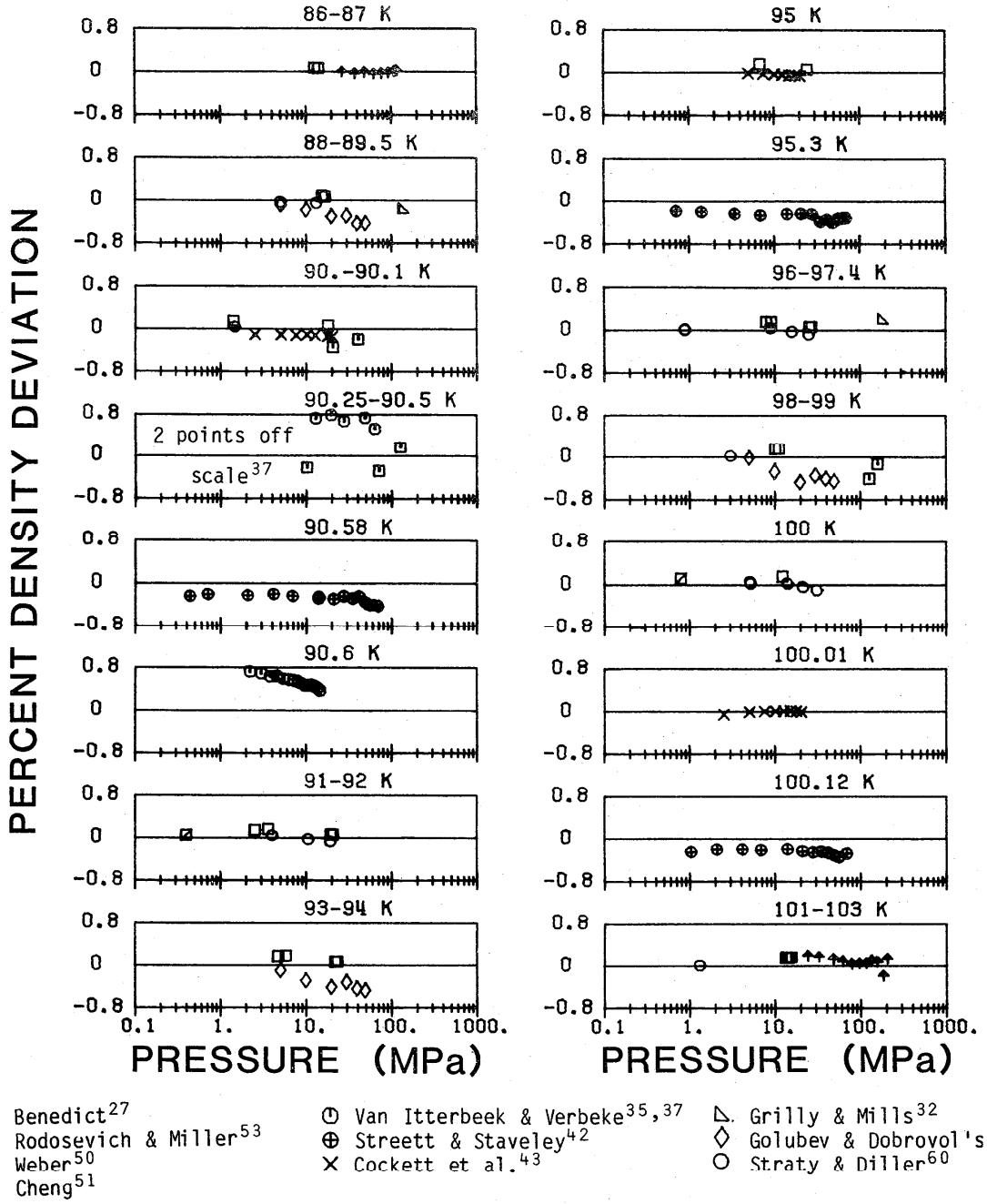

FIG. 16. Comparisons of calculated values of density to data for the liquid below the critical temperature—continued.

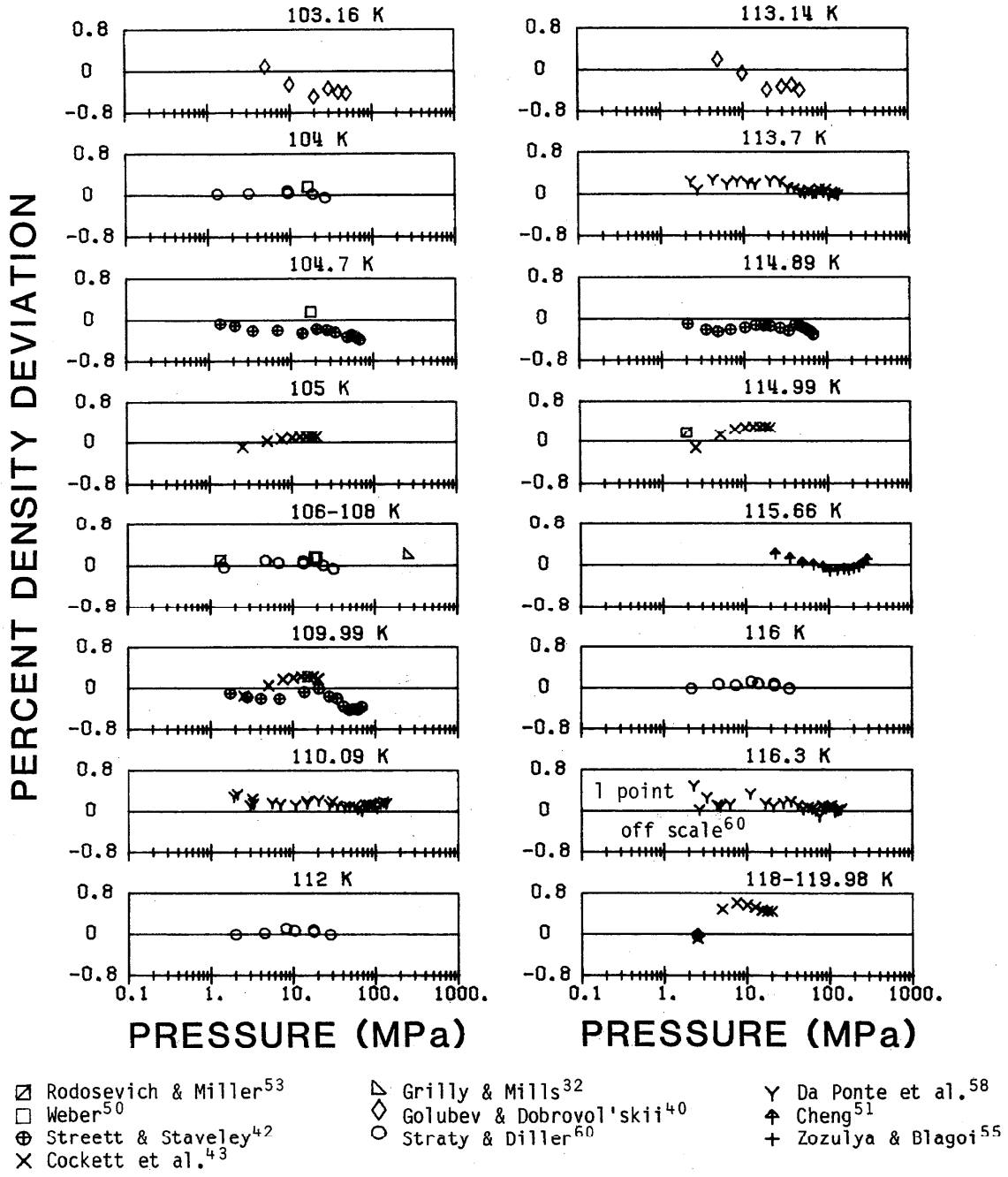

FIG. 16. Comparisons of calculated values of density to data for the liquid below the critical temperature—continued.

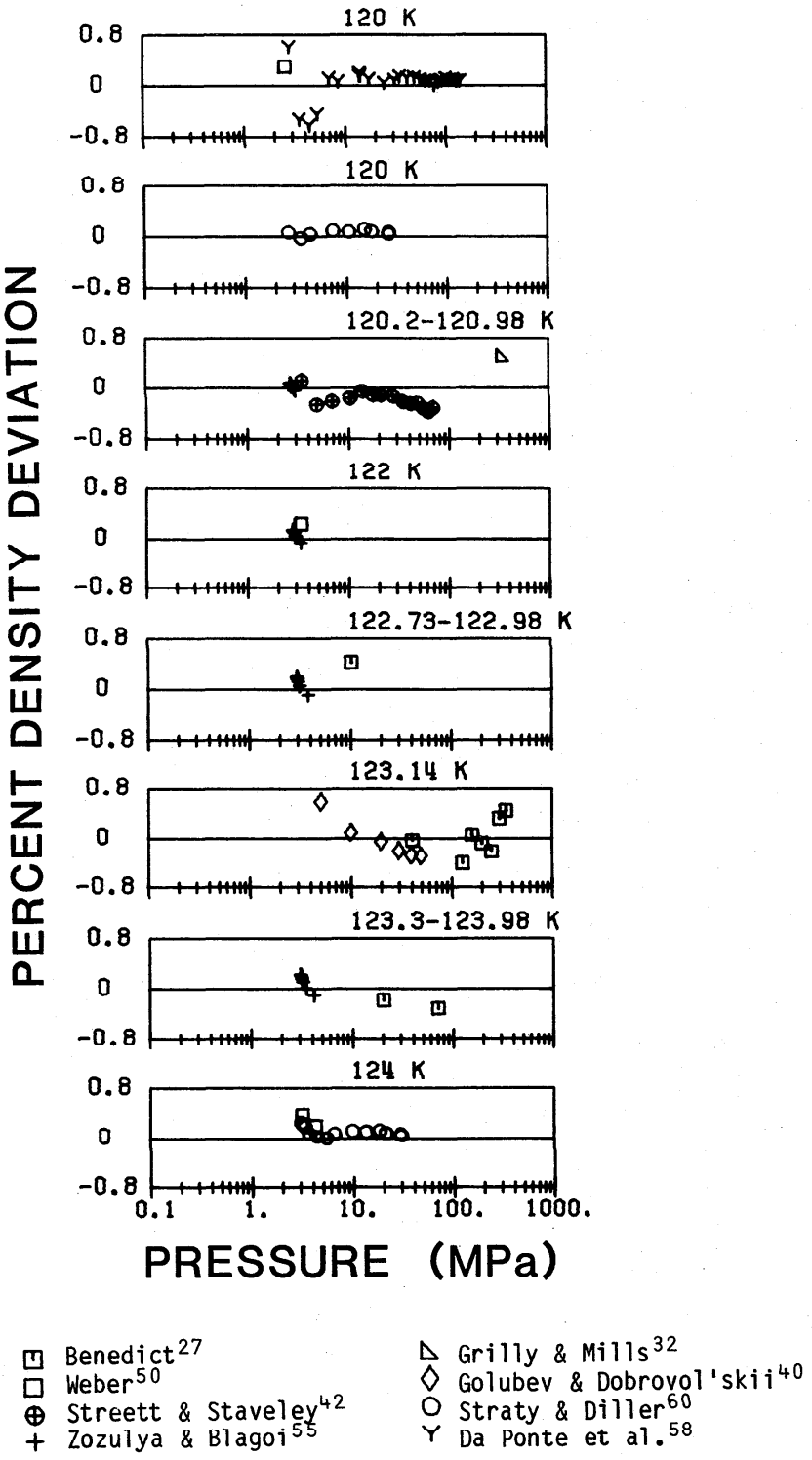

FIG. 16. Comparisons of calculated values of density to data for the liquid below the critical temperature—continued.

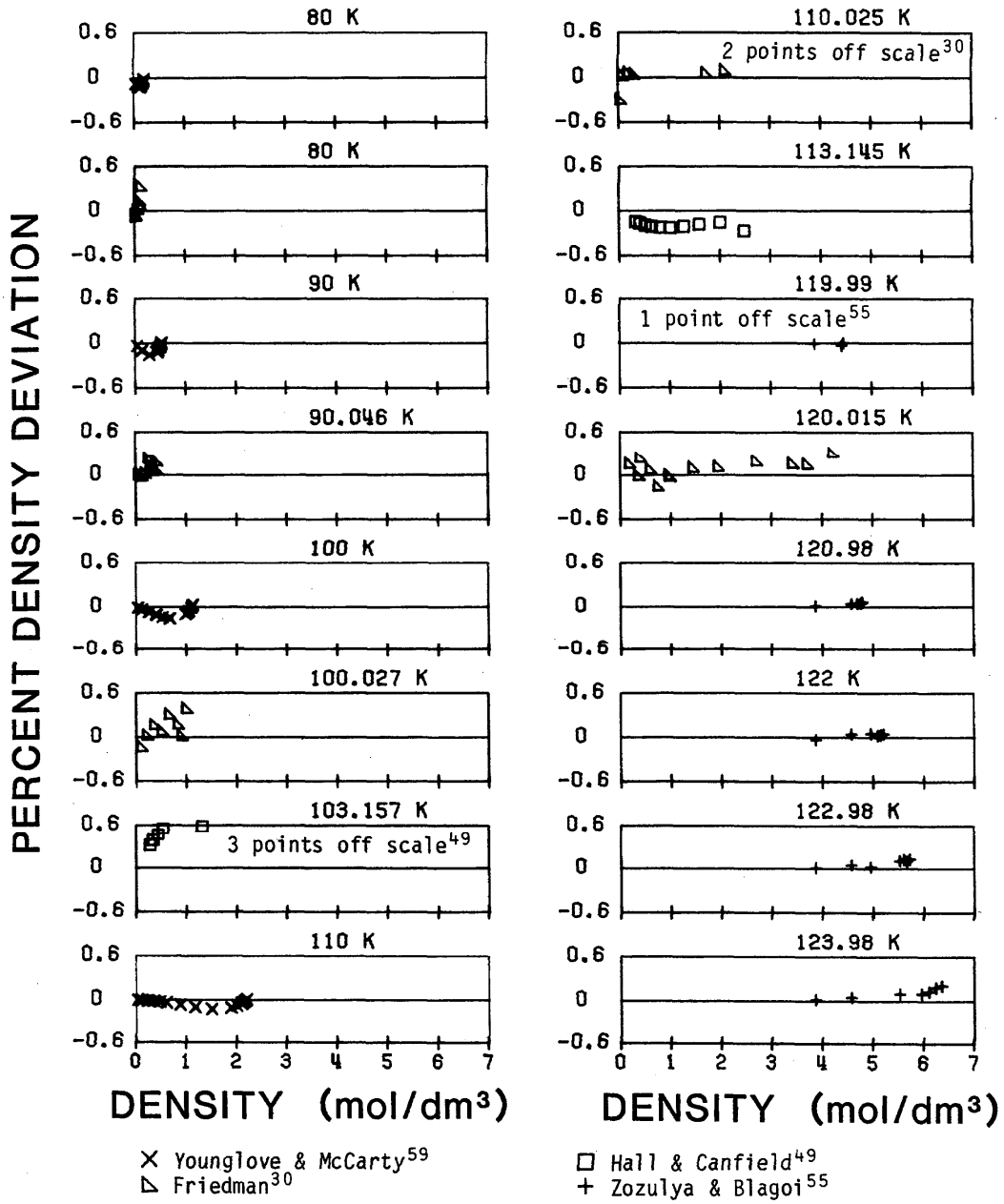

FIG. 17. Comparisons of calculated values of density to data for the vapor below the critical temperature.

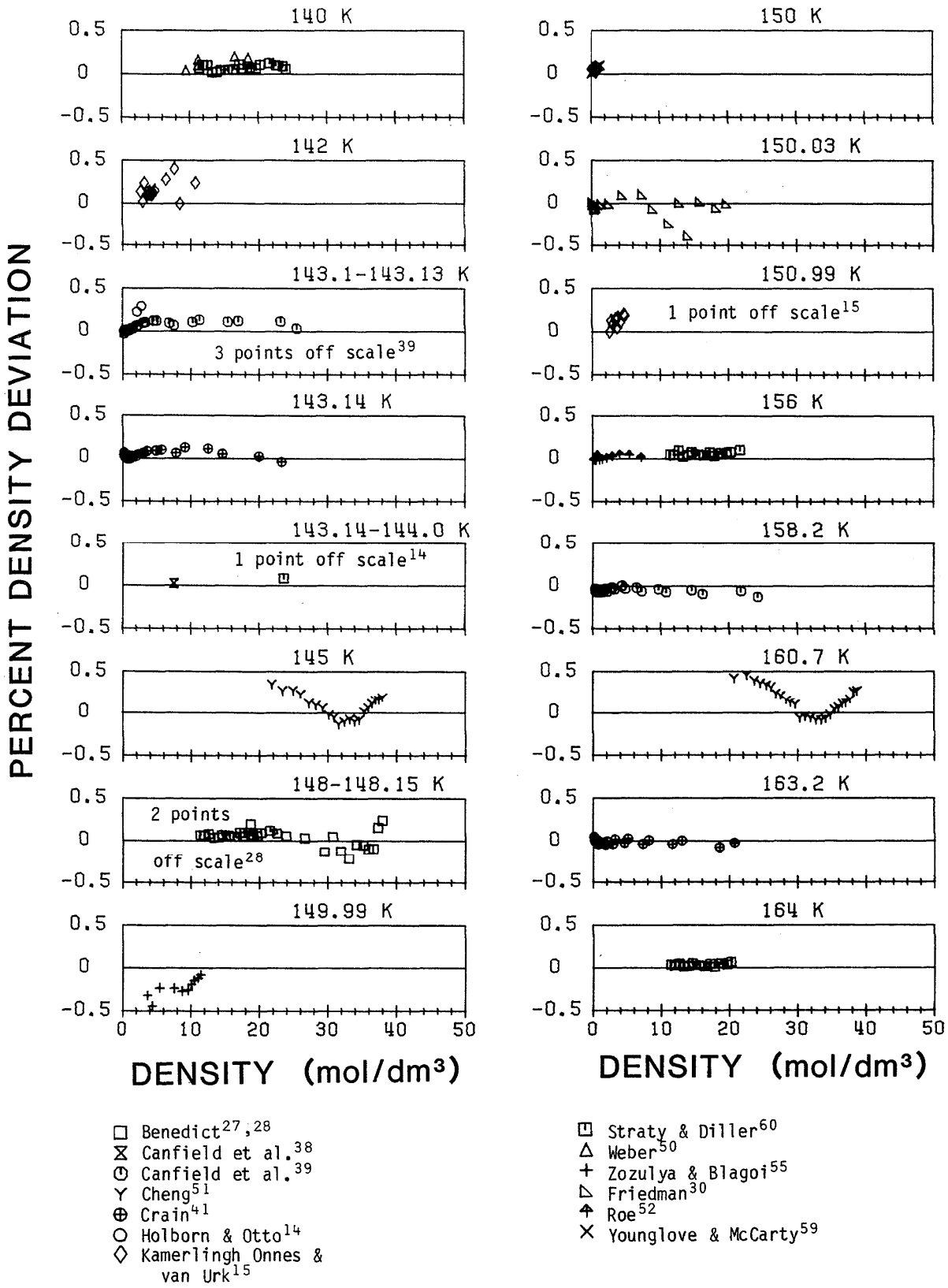

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature.

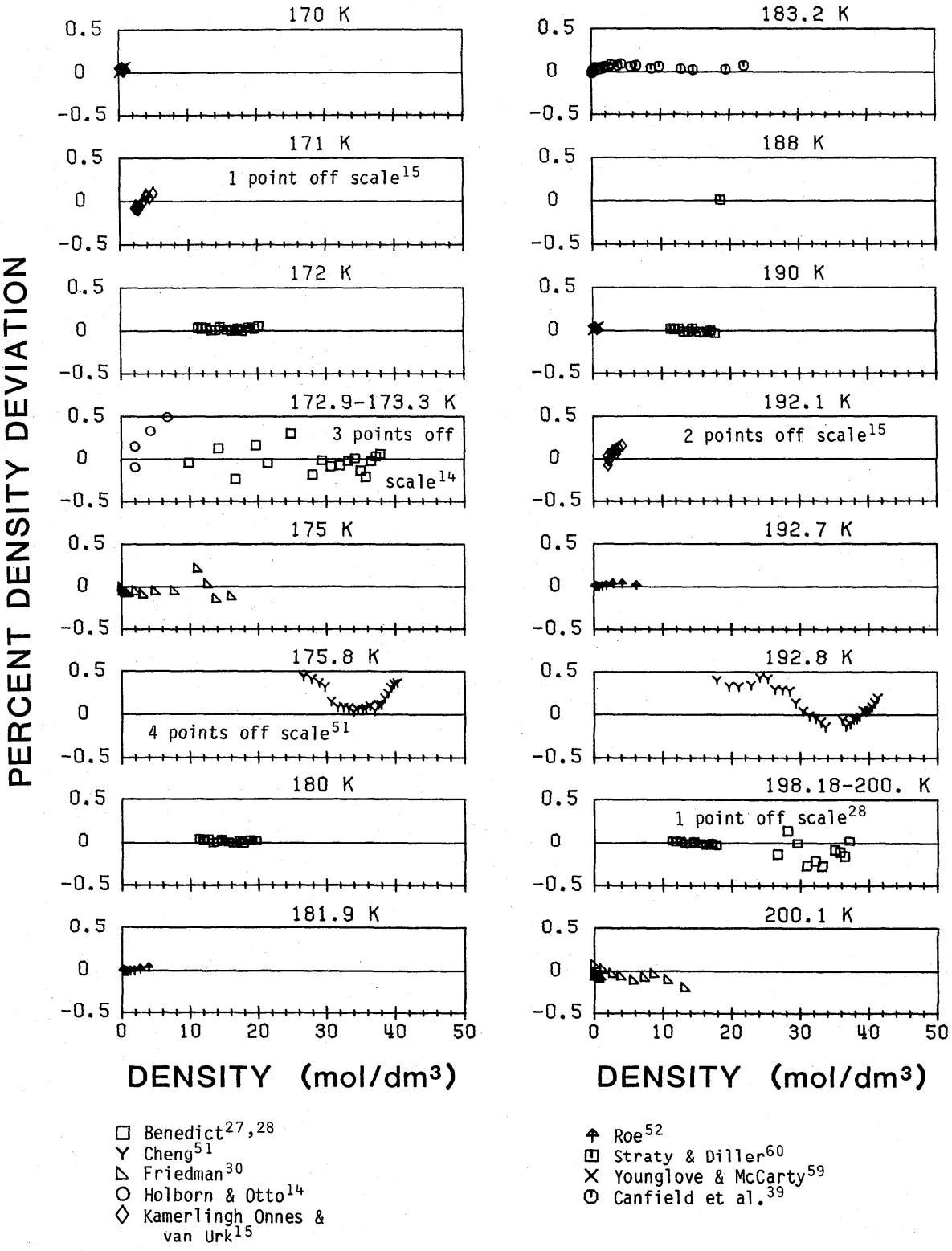

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature—continued.

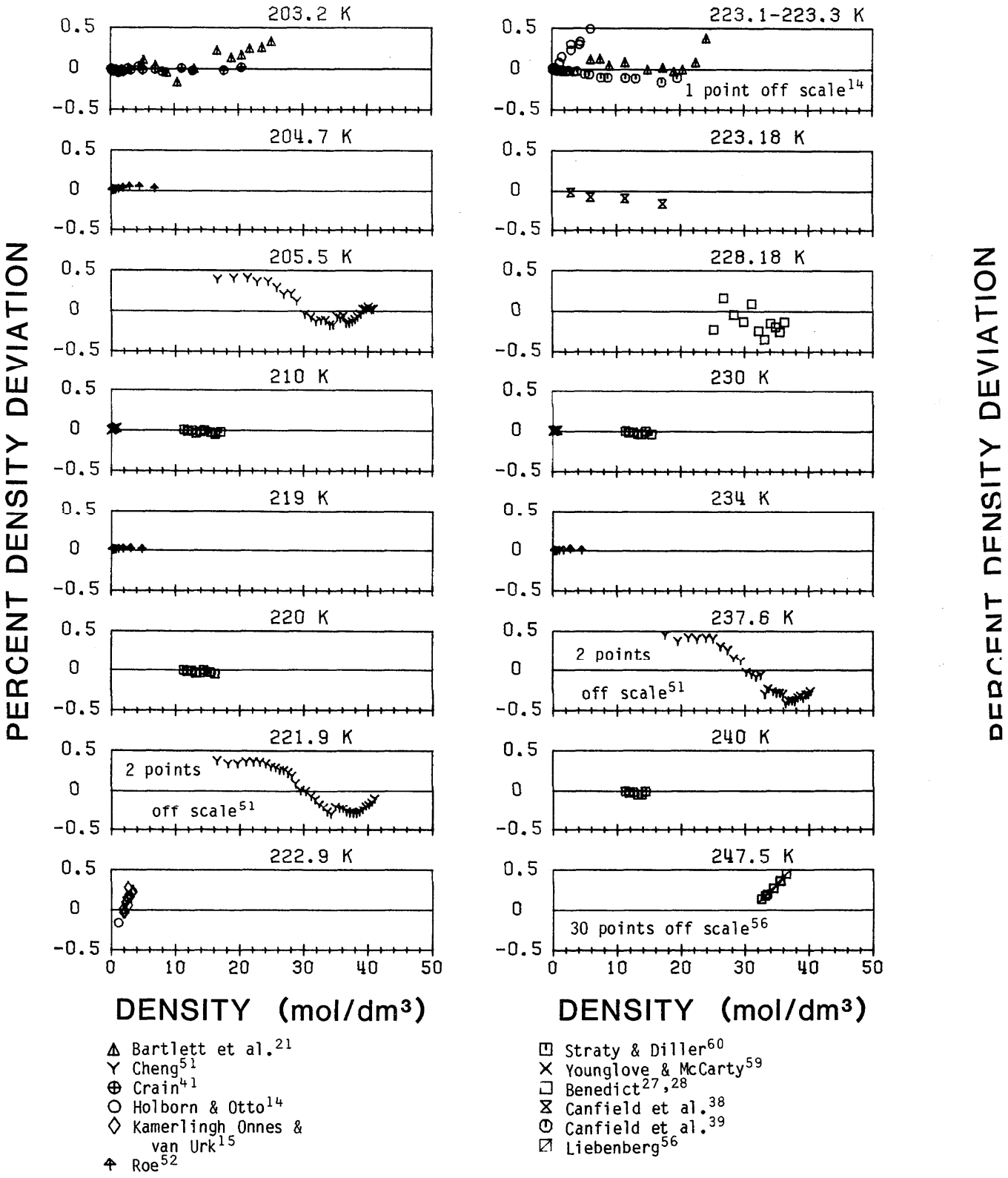

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature—continued.

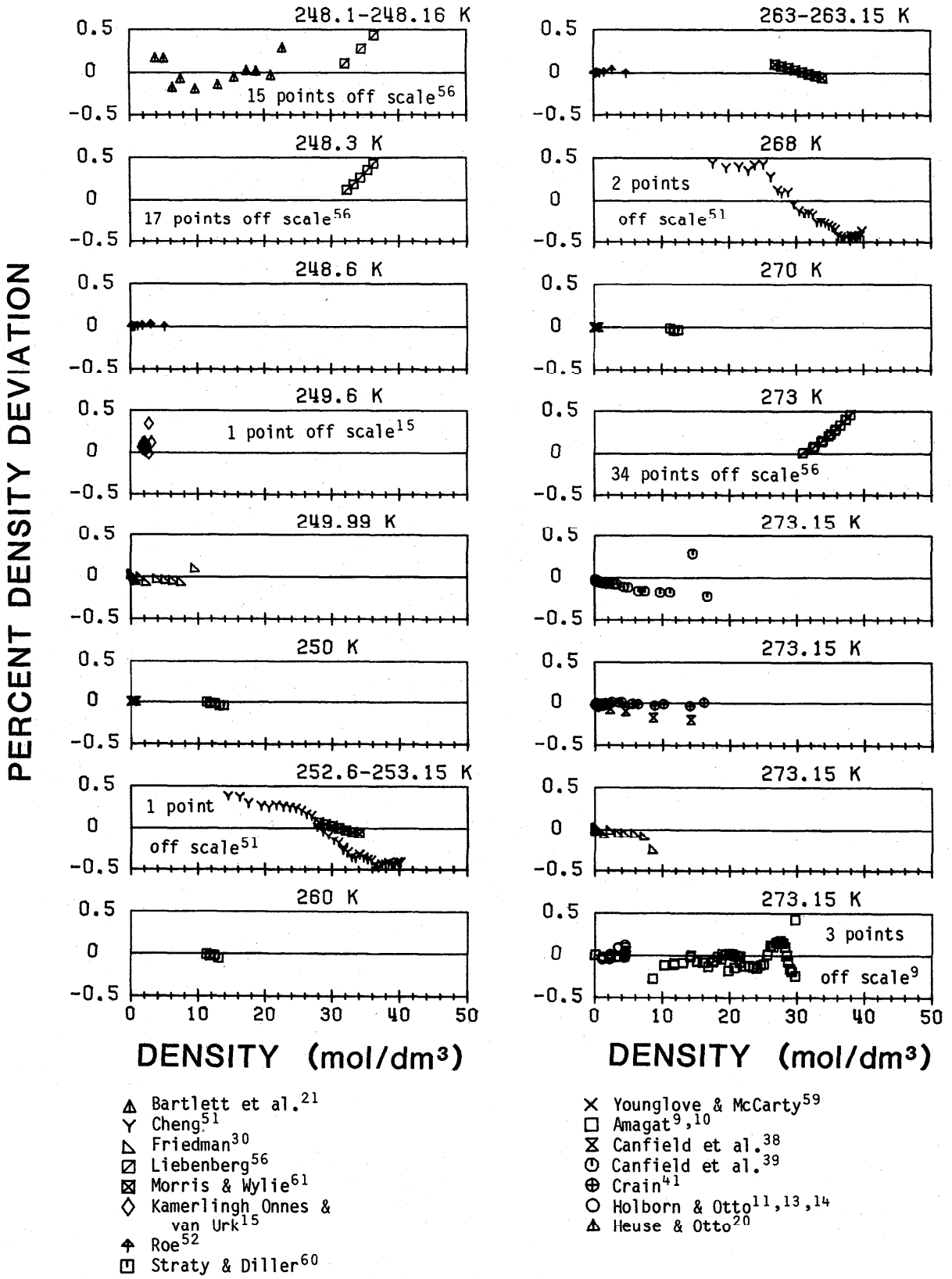

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature—continued.

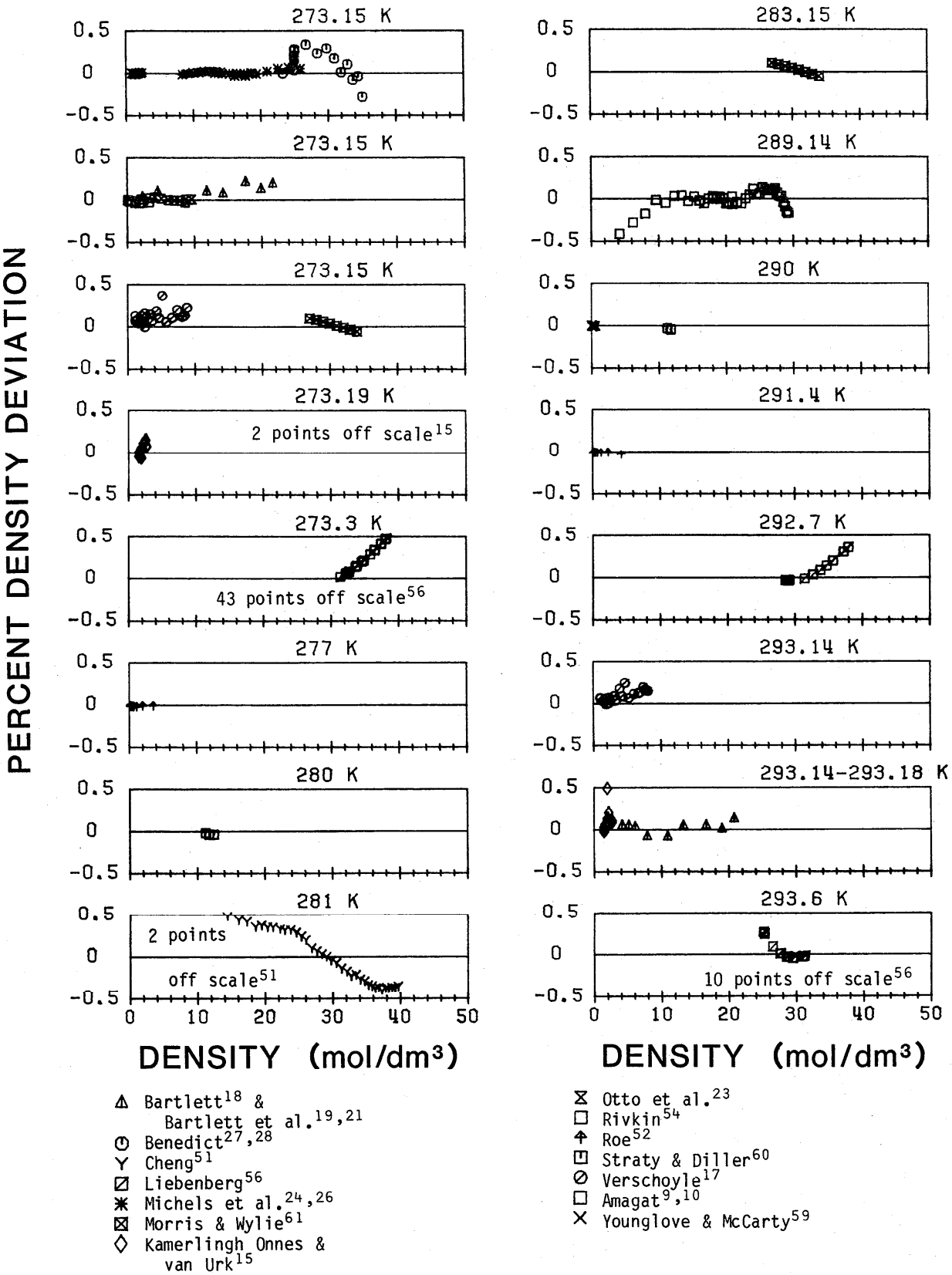

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature—continued.

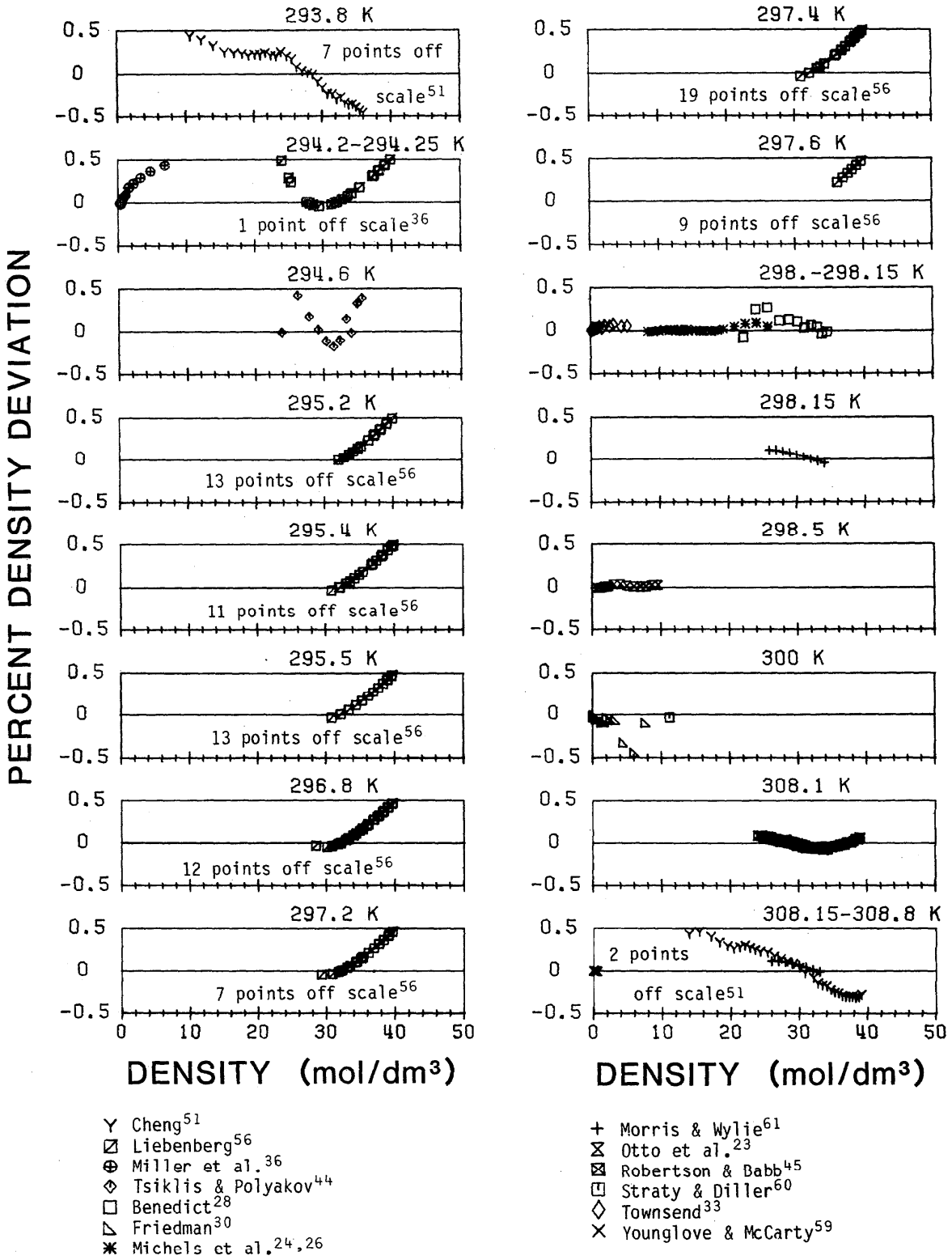

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature—continued.

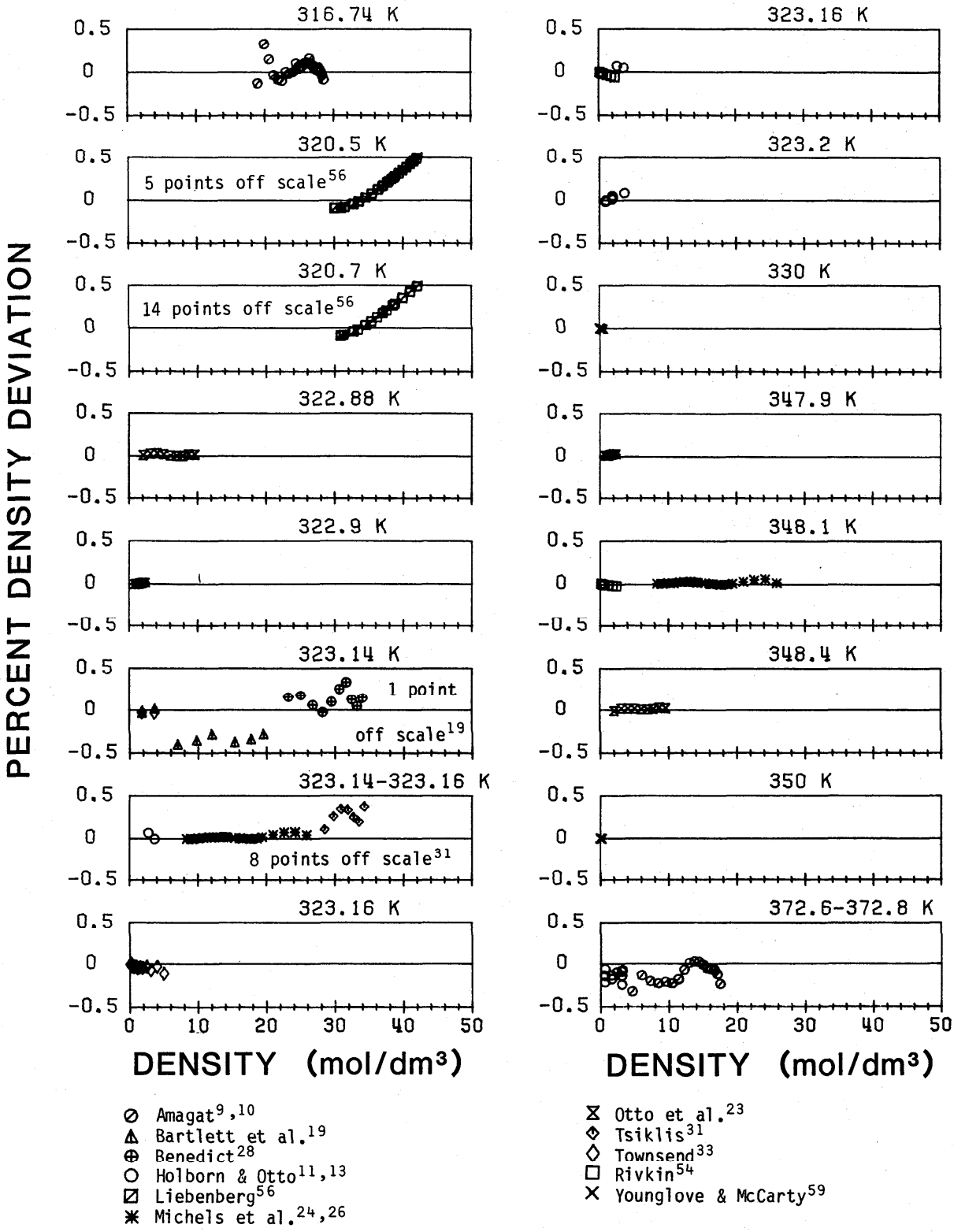

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature—continued.

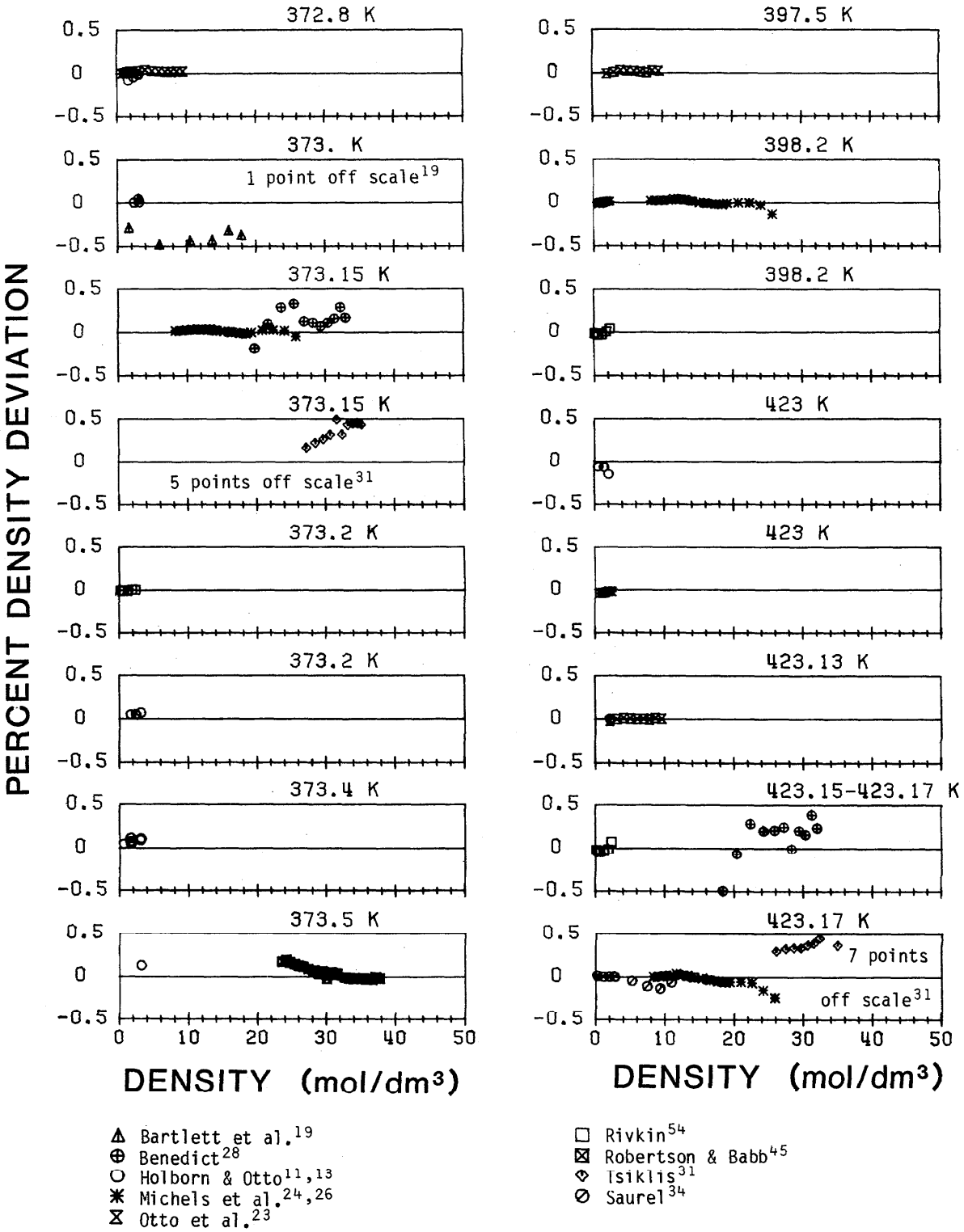

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature—continued.

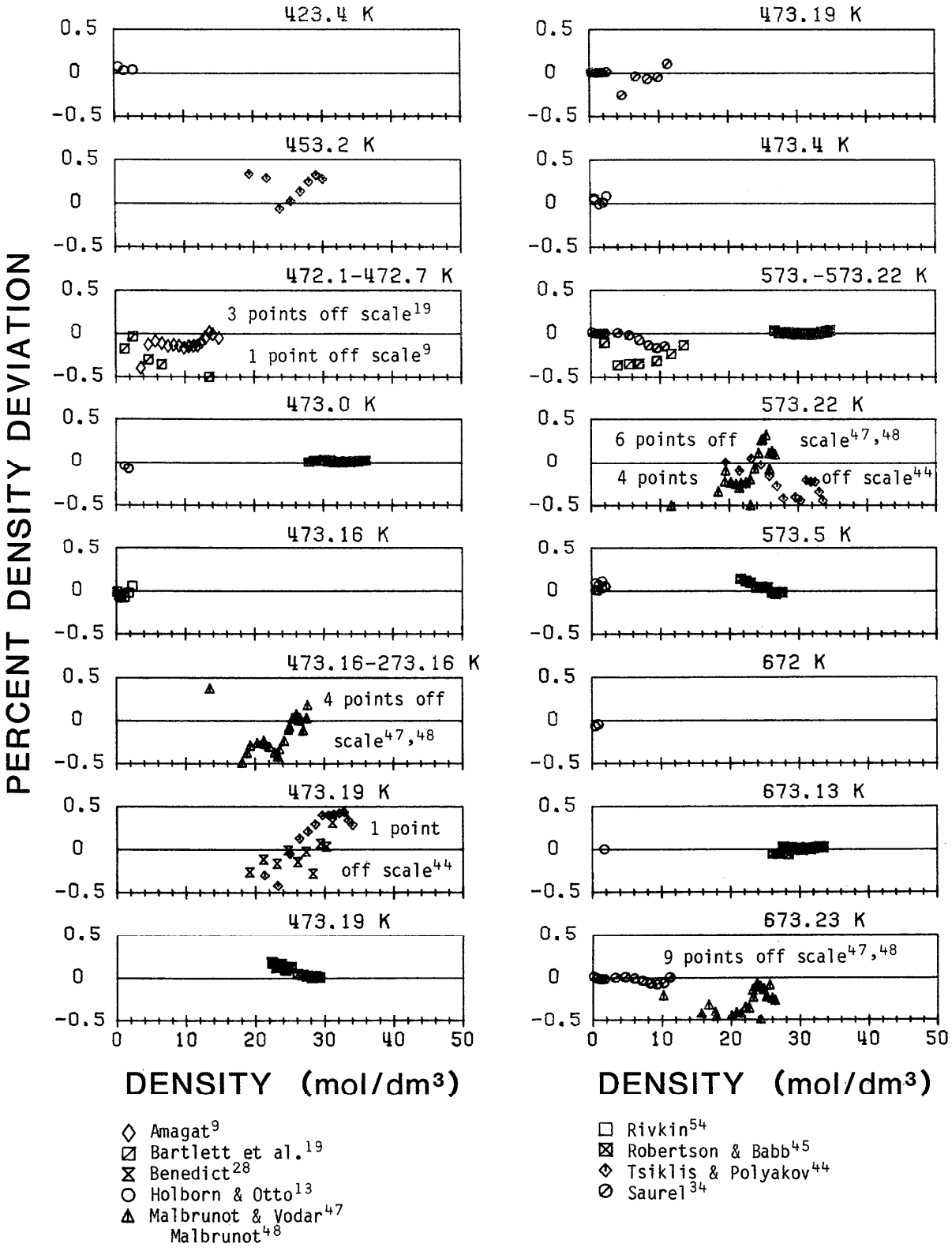

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature—continued.

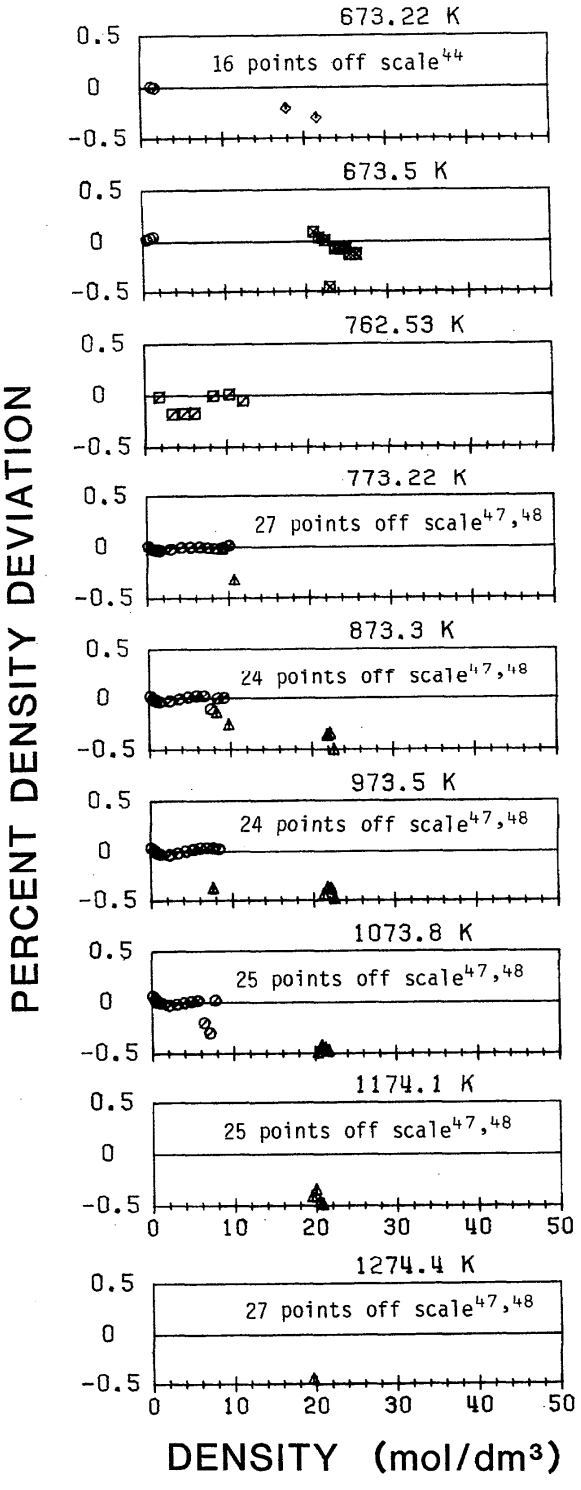

FIG. 18. Comparisons of calculated values of density to data for fluid states above the critical temperature—continued.

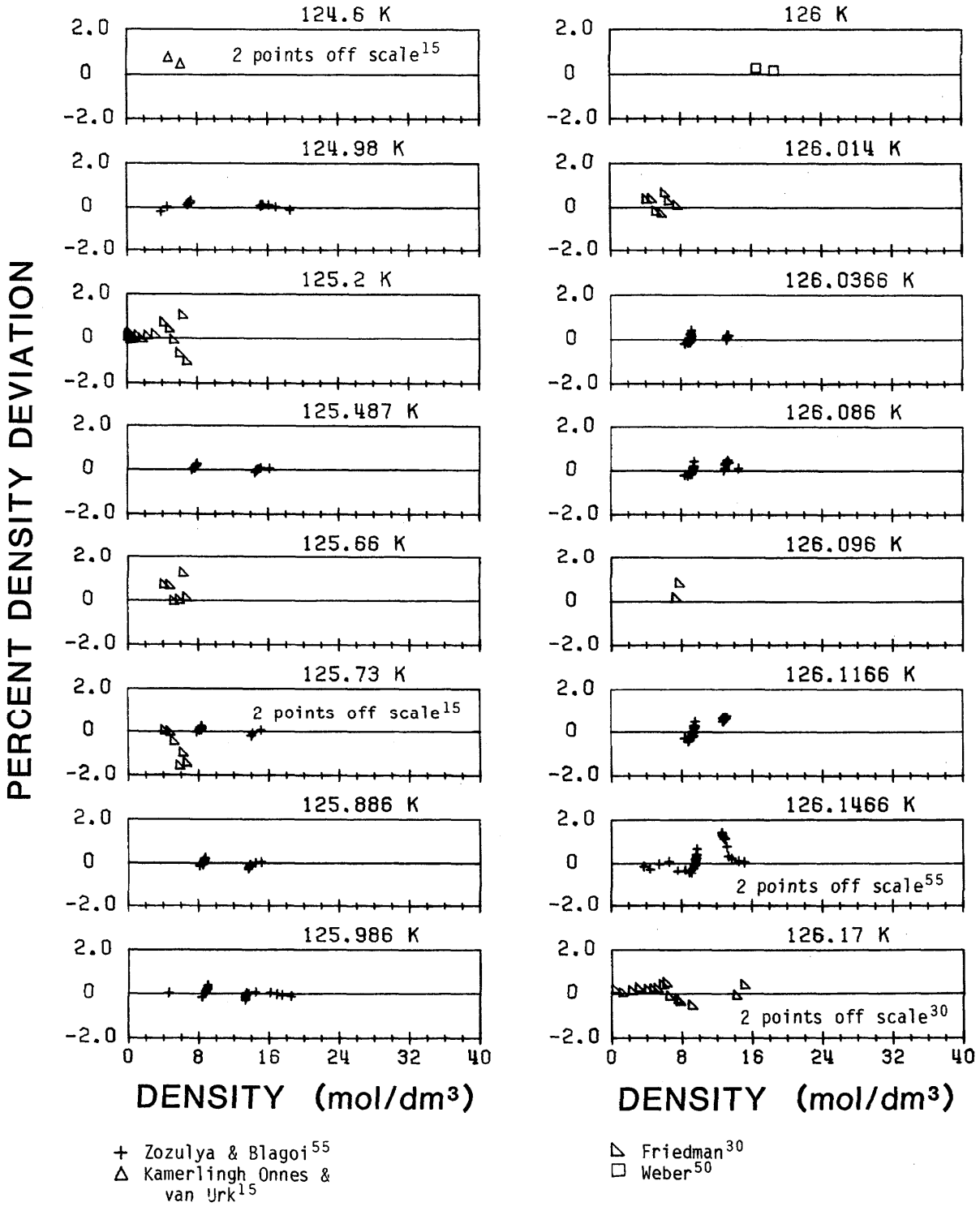

FIG. 19. Comparisons of calculated values of density to data near the critical temperature. ($T_c = 126.193$ K, $\rho_c = 11.177$ mol/dm^3.)

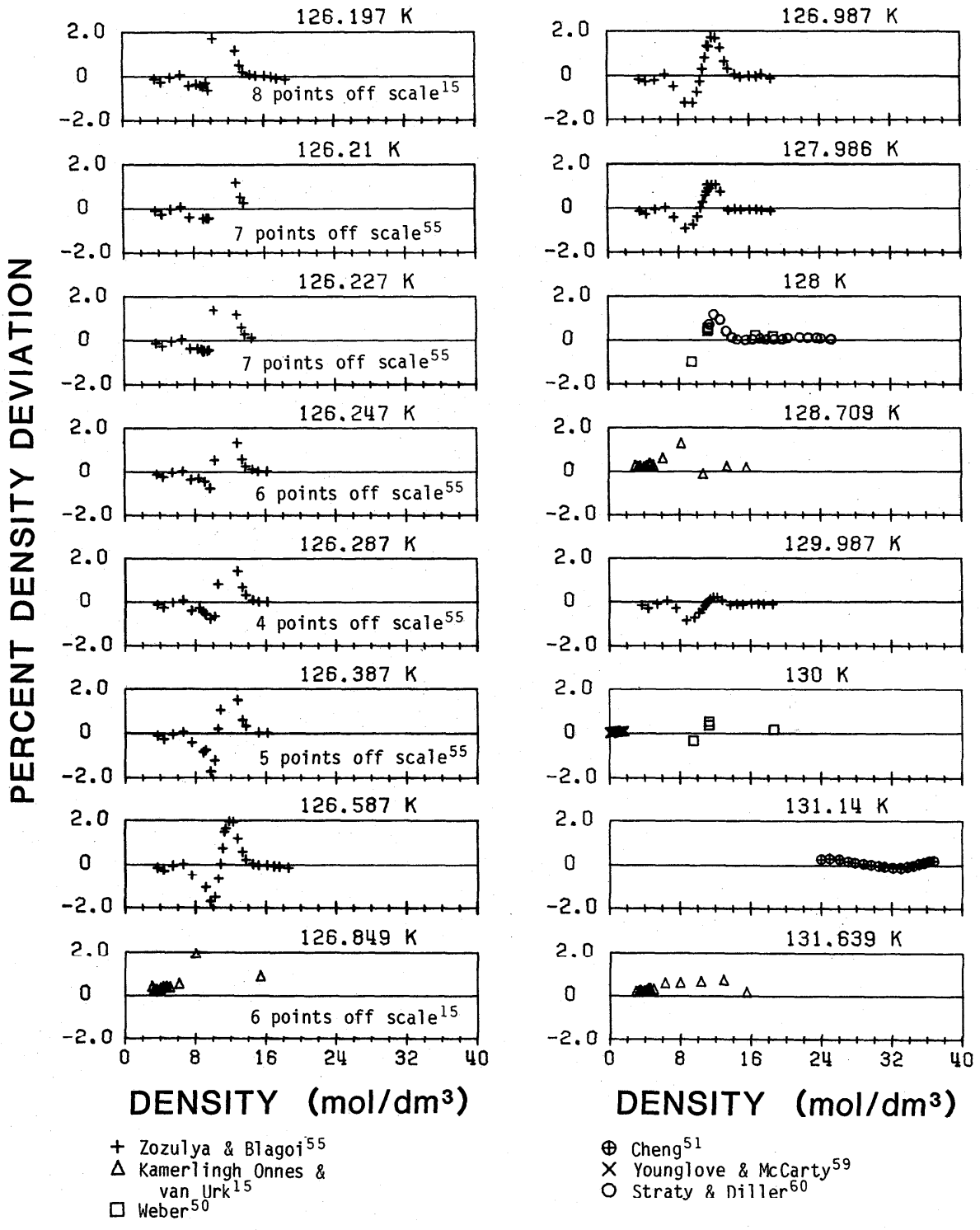

FIG. 19. Comparisons of calculated values of density to data near the critical temperature. ($T_c = 126.193$ K, $\rho_c = 11.177$ mol/dm^3)—continued.

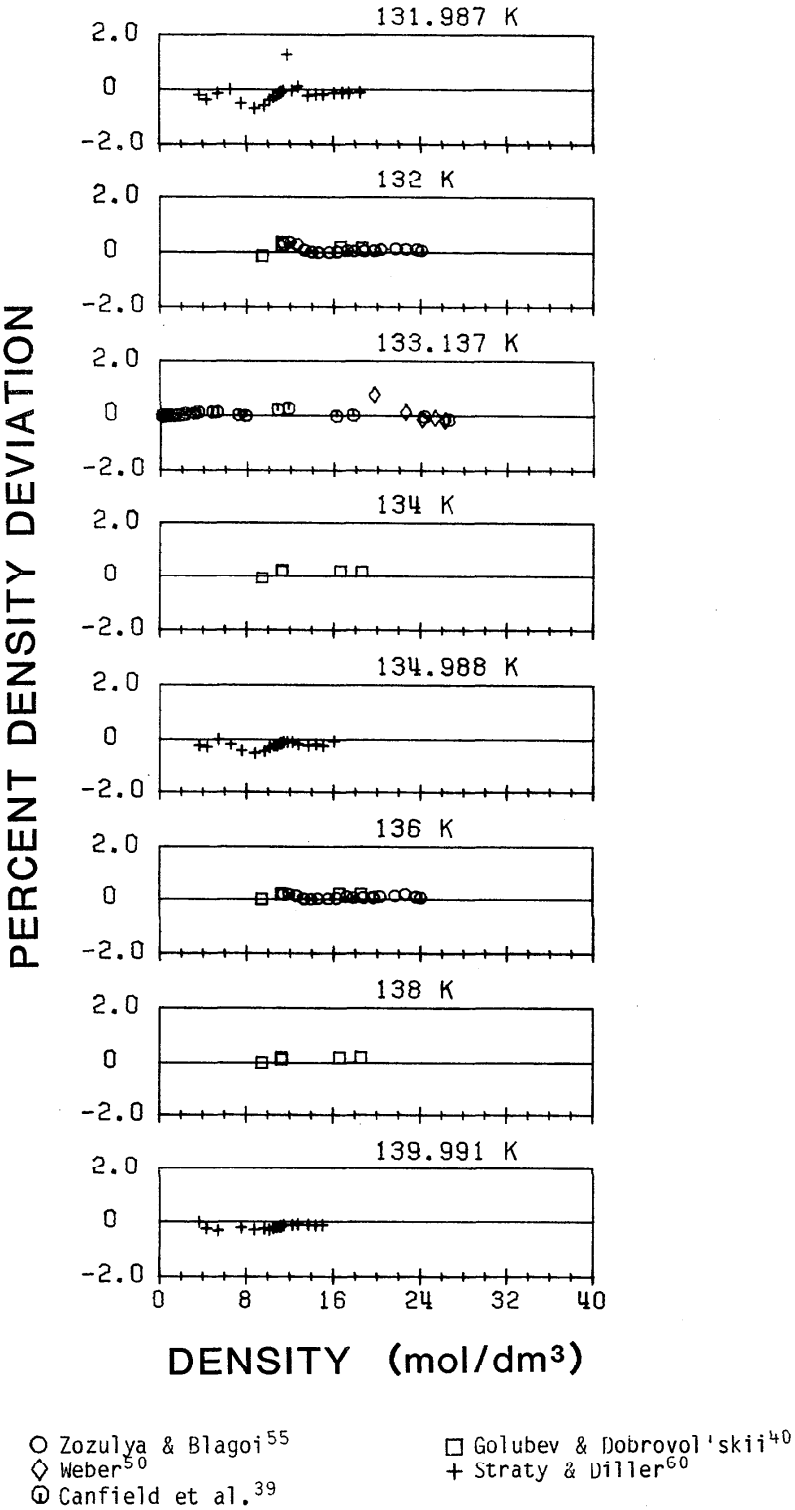

FIG. 19. Comparisons of calculated values of density to data near the critical temperature. (T_c = 126.193 K, ρ_c = 11.177 mol/dm^3)—continued.

6.2. Heat Capacity

Comparisons of values of the isochoric and isobaric heat capacity of nitrogen calculated with the fundamental equation to data values are shown in Figs. 20–22. The calculated values of heat capacity from Eq. (5.7) generally are in agreement within $\pm 2\%$ with available data. Maximum deviations are larger for data near the critical point.

6.2.1. Isochoric Heat Capacity

Figure 20 indicates that agreement of the calculated values from the fundamental equation with the available data for the isochoric heat capacity is within $\pm 2\%$. For temperatures close to T_c, the deviations of the heat capacity values on the critical isochore from Voronel[83] and Chashkin *et al.*[94] are in excess of 2% (between 5% and 20% for Voronel *et al.*[83] and up to 50% for Chashkin *et al.*[94]). These values are not included in Fig. 20.

Comparisons of the specific heat of the saturated liquid, C_σ, with calculated values from Eq. (5.7) are shown in Fig. 21. Agreement of these data with Eq. (5.7) is generally within $\pm 2\%$.

6.2.2. Isobaric Heat Capacity

Figures 22 and 23 illustrate comparisons of the isobaric heat capacity data for nitrogen with calculated values from Eq. (5.7). These figures indicate agreement between calculated and data values generally within $\pm 3\%$ in isobaric heat capacity.

6.3. Velocity of Sound

Figure 24 illustrates the comparisons between calculated values of velocity of sound from Eq. (5.7) and data values. Figure 25 is a similar comparison for saturated liquid and saturated vapor velocity of sound data. Calculated values from Eq. (5.7) are generally in agreement within $\pm 1\%$ in velocity of sound with the available data.

Figure 25 illustrates agreement of the saturated liquid velocity of sound data and calculated values from Eq. (5.7) within $\pm 2\%$ in velocity of sound. The deviations of the saturated liquid values calculated from Eq. (5.7) increase as temperature approaches both the critical temperature and the triple point temperature.

6.4. The Second Virial Coefficient

Figure 26 illustrates comparisons between calculated values of the second virial coefficient from Eq. (5.7) and the selected correlated values of Levelt Sengers *et al.*[82] from 100 to 1500 K. Table 20 lists values of the second virial coefficient for nitrogen. The values of the second virial coefficients calculated from Eq. (5.7) agree with those of Levelt Sengers *et al.*[82] within about $\pm 5\%$ below 500 K. The larger discrepancies at higher temperatures shown in Fig. 25 and Table 10 are not explained. Extrapolation of the fundamental equation beyond the range of this correlation is not recommended.

6.5. Maxwell Criterion

Figure 27 illustrates comparisons of values of vapor pressure, saturated liquid density, and saturated vapor density with values calculated from Eqs. (3.1), (3.2), and (3.3), respectively. In addition, Fig. 27 includes comparisons to saturation properties calculated from Eq. (5.7) using the Maxwell criterion. The values calculated from Eq. (5.7) using the Maxwell criterion are in good agreement (within $+0.01\%$) with values calculated from Eqs. (3.1), (3.2), and (3.3), and with selected data.

6.6. Enthalpy

The comparisons of data with calculated values of enthalpy from Eq. (5.7) given in Fig. 28 indicate that Eq. (5.7) may be used to predict values of enthalpy accurately except in the critical region. No claim for accuracy in the critical region is made.

6.7. Enthalpy of Vaporization

Figure 29 illustrates comparisons with data of values of the enthalpy of vaporization (latent heat) calculated from Eq. (5.7) using saturation densities calculated from Eq. (5.7) by applying the Maxwell criterion at the data temperature. The deviations of calculated and experimental values are generally within $\pm 2\%$. Deviations of calculated values of the enthalpy of vaporization at states near the critical point are as large as $\pm 3\%$.

6.8. The Critical Region

The critical region for the equation of state for nitrogen is arbitrarily defined to include states at temperatures between 124.5 and 140 K at densities from 7.5 to 15 mol/dm^3. The revised and extended scaling model of Jahangiri and Jacobsen[7] is considered to be the most accurate representation of available data for nitrogen in this region. The fundamental Eq. (5.7) was determined by least-squares fitting of selected data with constrained temperature, pressure, density, $(\partial P/\partial \rho)_T$, and $(\partial^2 P/\partial \rho^2)_T$ at the critical point. The critical-point parameters of the fundamental equation are identical to those given by Zozulya and Blagoi,[55] as required by the constraints.

Comparisons of calculated and measured density values in the critical region are included in Fig. 19. Additional comparisons of P-ρ-T data in the critical region are given in Figs. 30–33. Figures 32 and 33 illustrate comparisons of values of pressure and density calculated from Eq. (5.7) with values from the revised and extended scaling equation of Jahangiri and Jacobsen.[7] The range of validity of the model of Jahangiri and Jacobsen[7] is between 7 and 15 mol/dm^3. The P-ρ-T graphs of this section extend beyond this range of validity to illustrate the relative agreement with data outside the critical region.

Significant discrepancies in calculated density values are apparent in Fig. 33. Agreement of calculated values of derived properties including C_v, C_p, enthalpy, internal energy, entropy, and velocity of sound with values from the revised and extended formulation of Jahangiri and Jacobsen[7] was not expected. The anomalous behavior of calorimetric

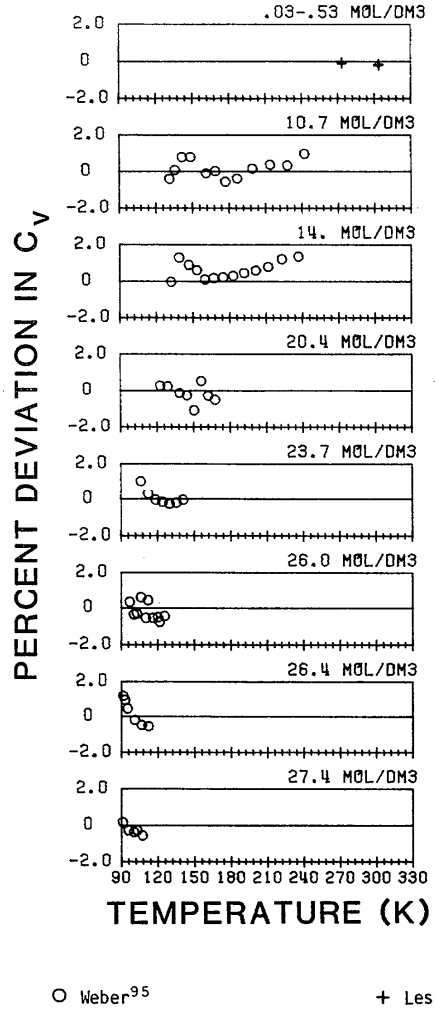

FIG. 20. Comparisons of calculated values of isochoric heat capacity, C_v, to data.

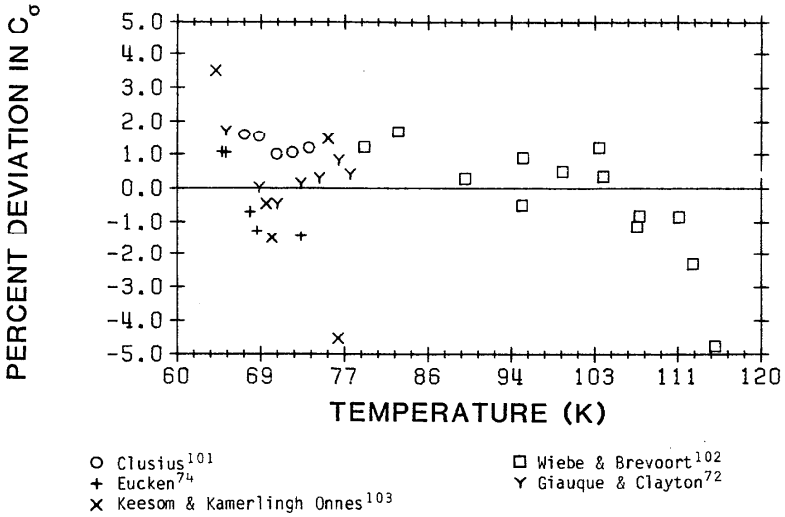

FIG. 21. Comparisons of calculated values of heat capacity, C_σ, to data.

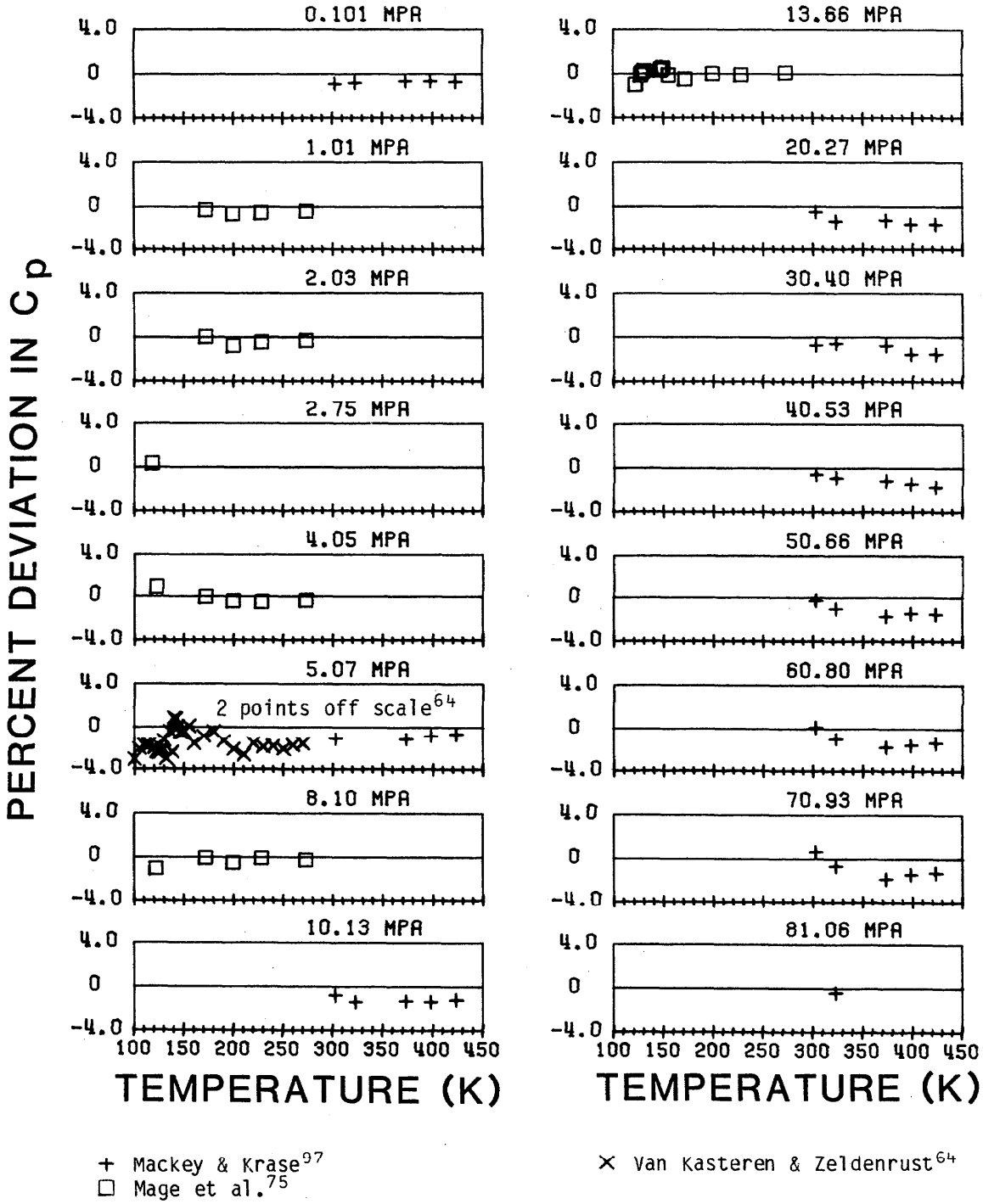

FIG. 22. Comparisons of calculated values of isobaric heat capacity, C_p, to data (isobaric data).

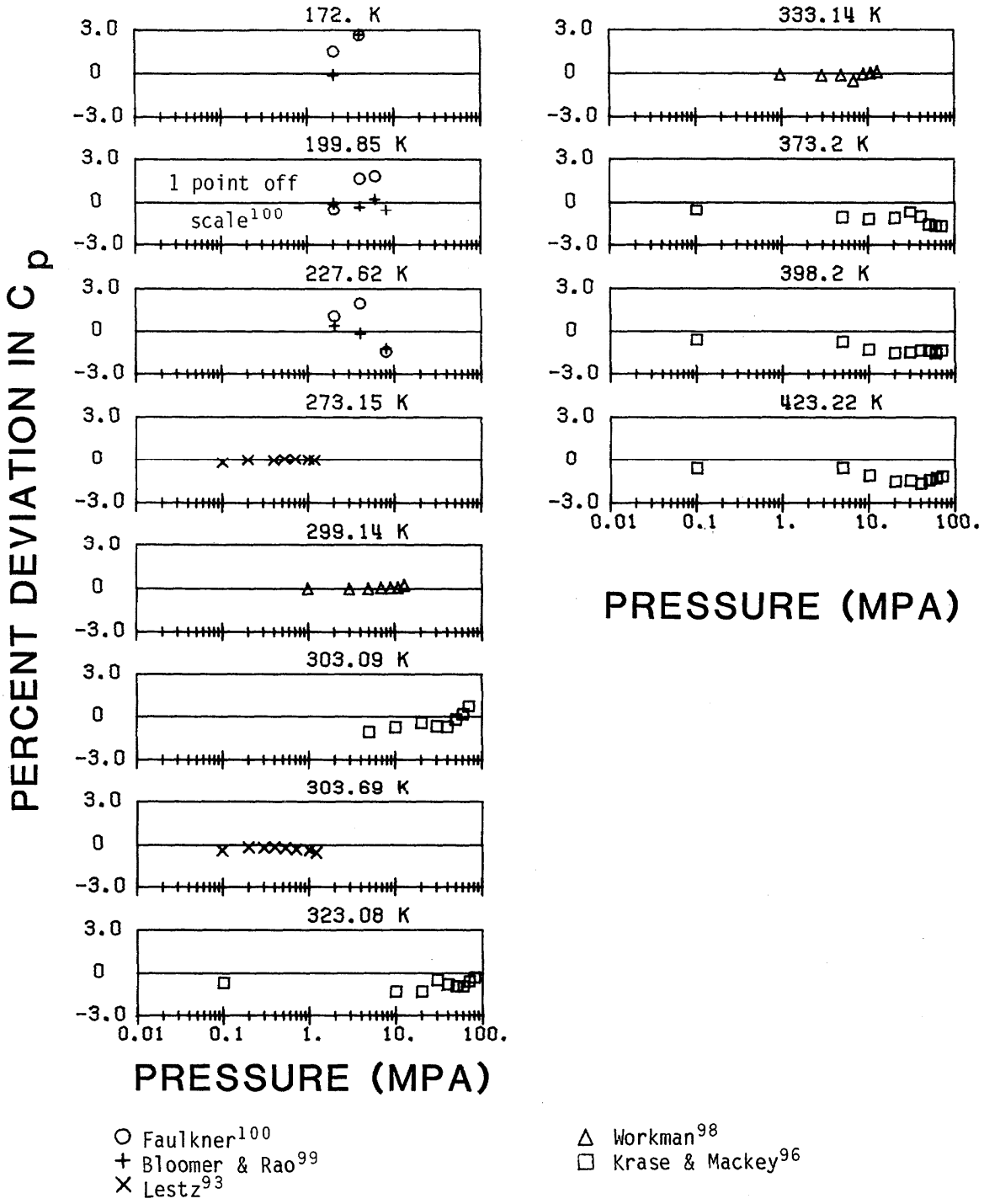

FIG. 23. Comparisons of calculated values of isobaric heat capacity, C_p, to data (isothermal data).

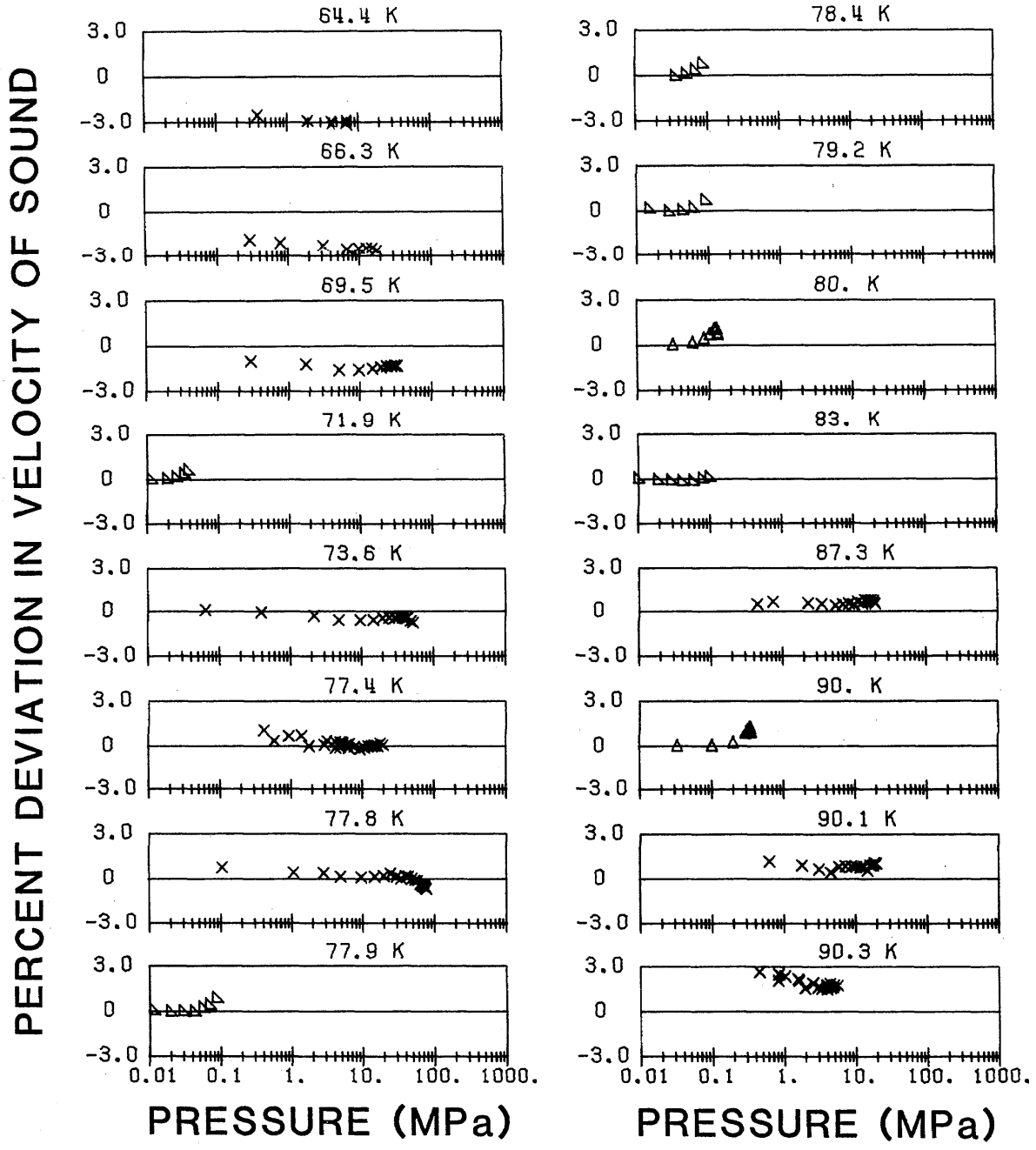

FIG. 24. Comparisons of calculated values of velocity of sound to data.

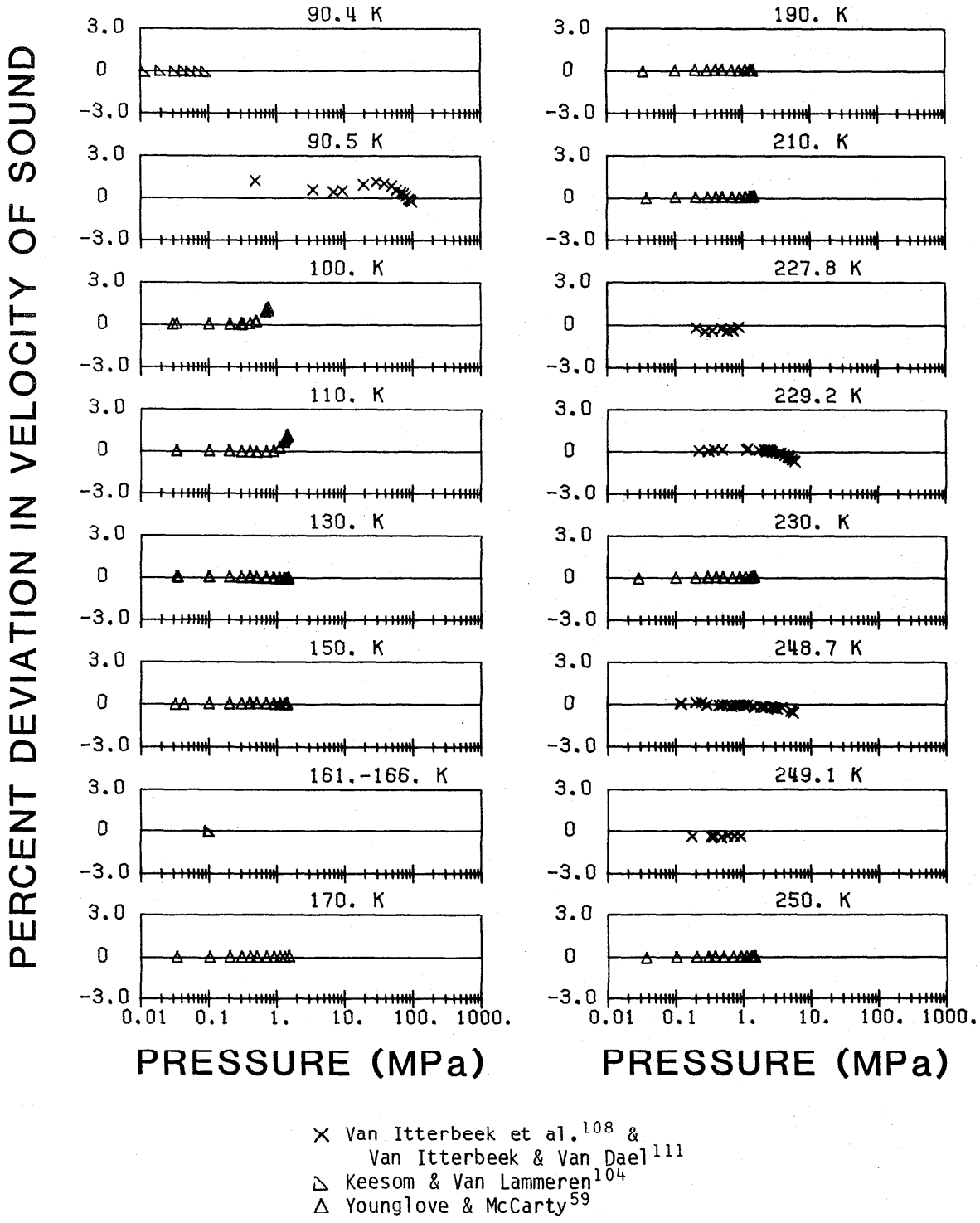

FIG. 24. Comparisons of calculated values of velocity of sound to data—continued.

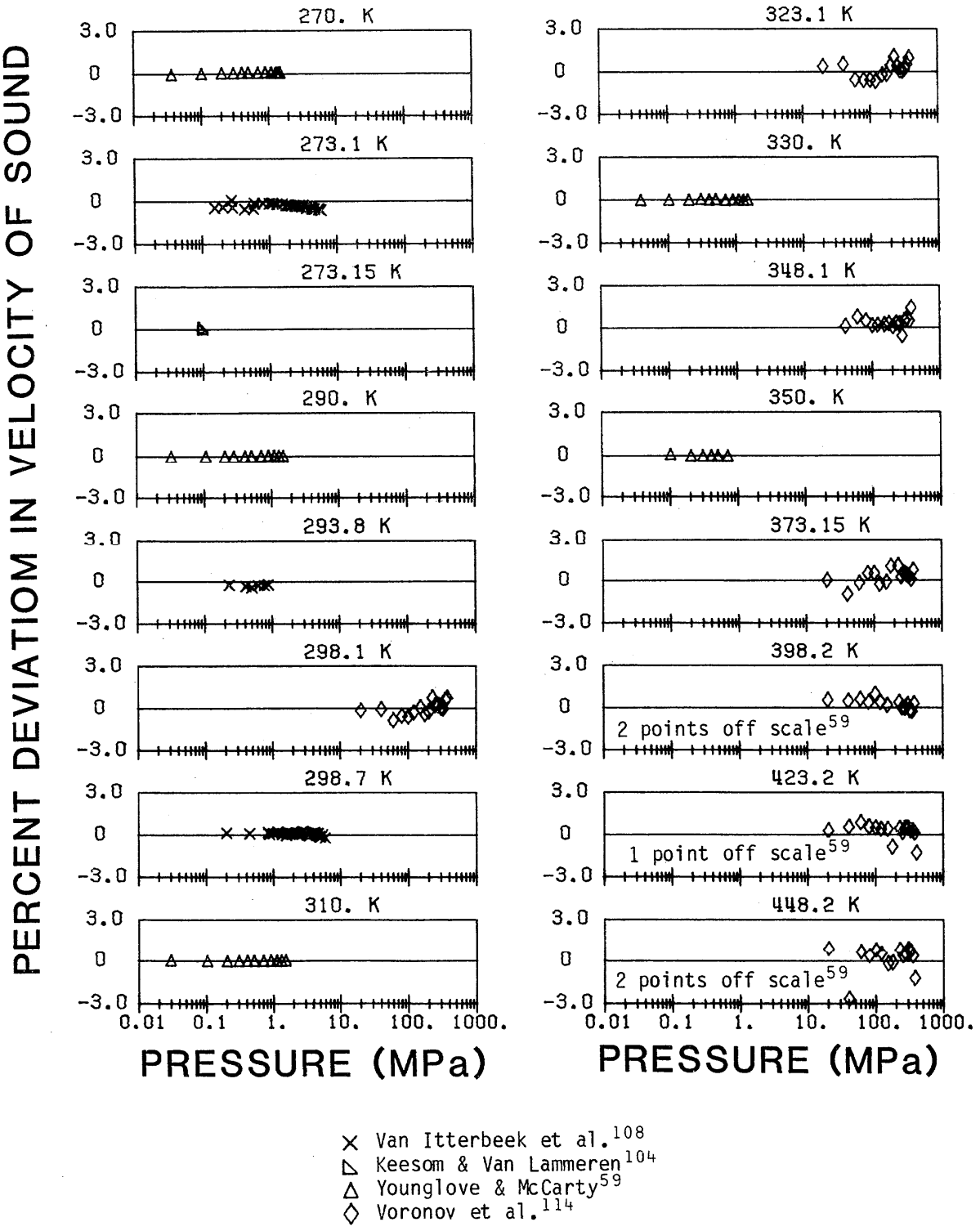

FIG. 24. Comparisons of calculated values of velocity of sound to data—continued.

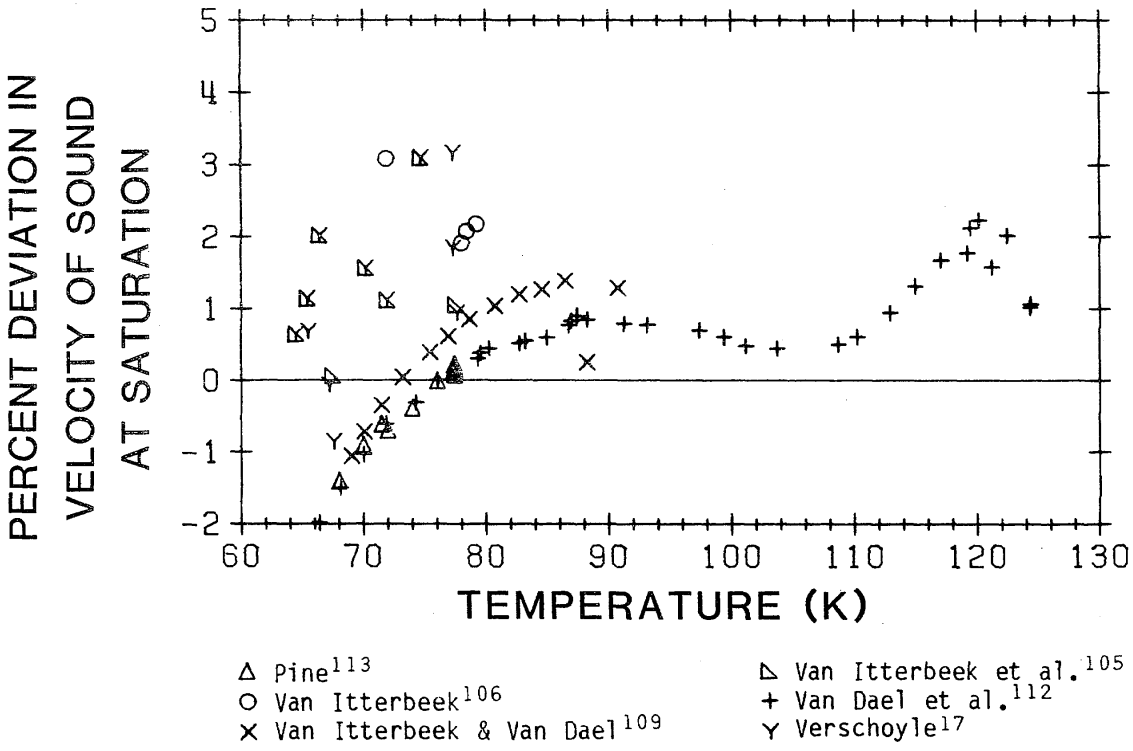

FIG. 25. Comparisons of calculated values of the velocity of sound at saturation to data.

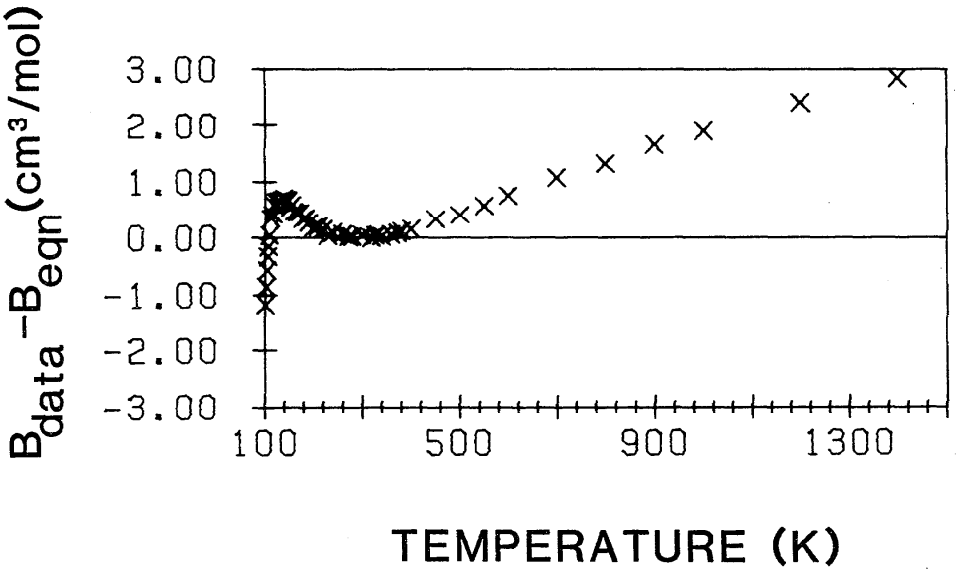

FIG. 26. Comparisons of calculated second virial coefficients with values from Levelt Sengers *et al.* (Ref. 82).

Table 20. Second virial coefficients for nitrogen

Temperature (K)	B (cm^3/mol) Equation (5.7)	Levelt Sengers et al.[82]
100	-158.83	-160.00
102	-153.25	-154.10
104	-147.94	-148.50
106	-142.88	-143.20
108	-138.05	-138.20
110	-133.45	-133.40
112	-129.05	-128.70
116	-120.82	-120.40
120	-113.28	-112.70
124	-106.35	-105.70
128	- 99.96	- 99.30
132	- 94.06	- 93.40
136	- 88.59	- 87.90
140	- 83.51	- 82.80
144	- 78.78	- 78.10
148	- 74.37	- 73.70
152	- 70.25	- 69.70
156	- 66.40	- 65.80
160	- 62.78	- 62.30
166	- 57.75	- 57.30
172	- 53.15	- 52.70
178	- 48.94	- 48.60
184	- 45.06	- 44.70
190	- 41.47	- 41.20
200	- 36.08	- 35.90
210	- 31.30	- 31.10
220	- 27.05	- 26.90
230	- 23.23	- 23.20
240	- 19.80	- 19.70
260	- 13.86	- 13.80
273	- 10.52	- 10.50
280	- 8.92	- 8.90
300	- 4.76	- 4.70
320	- 1.20	- 1.20
340	1.87	1.90
360	4.54	4.60
373	6.11	6.20
380	6.88	7.00
400	8.94	9.10
450	13.16	13.50
500	16.39	16.80
550	18.92	19.50
600	20.94	21.70
700	23.92	25.00
800	25.98	27.30
900	27.44	29.10
1000	28.50	30.40
1200	29.88	32.30
1400	30.65	33.50

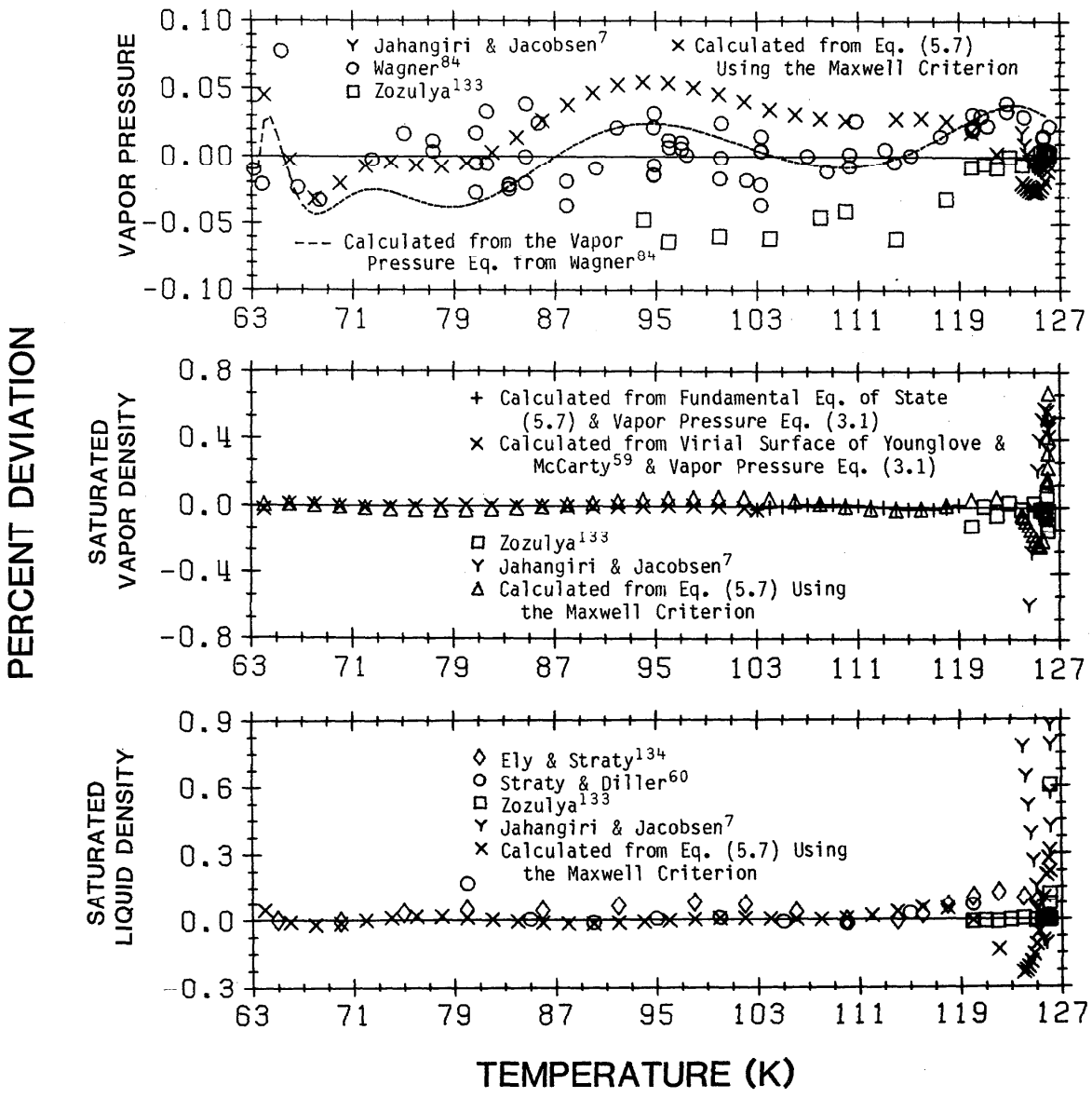

FIG. 27. Comparisons of selected coexistence property data and values calculated from Eq. (5.7) using the Maxwell criterion (equal area principle) with calculated values from Eqs. (3.1), (3.2), and (3.3).

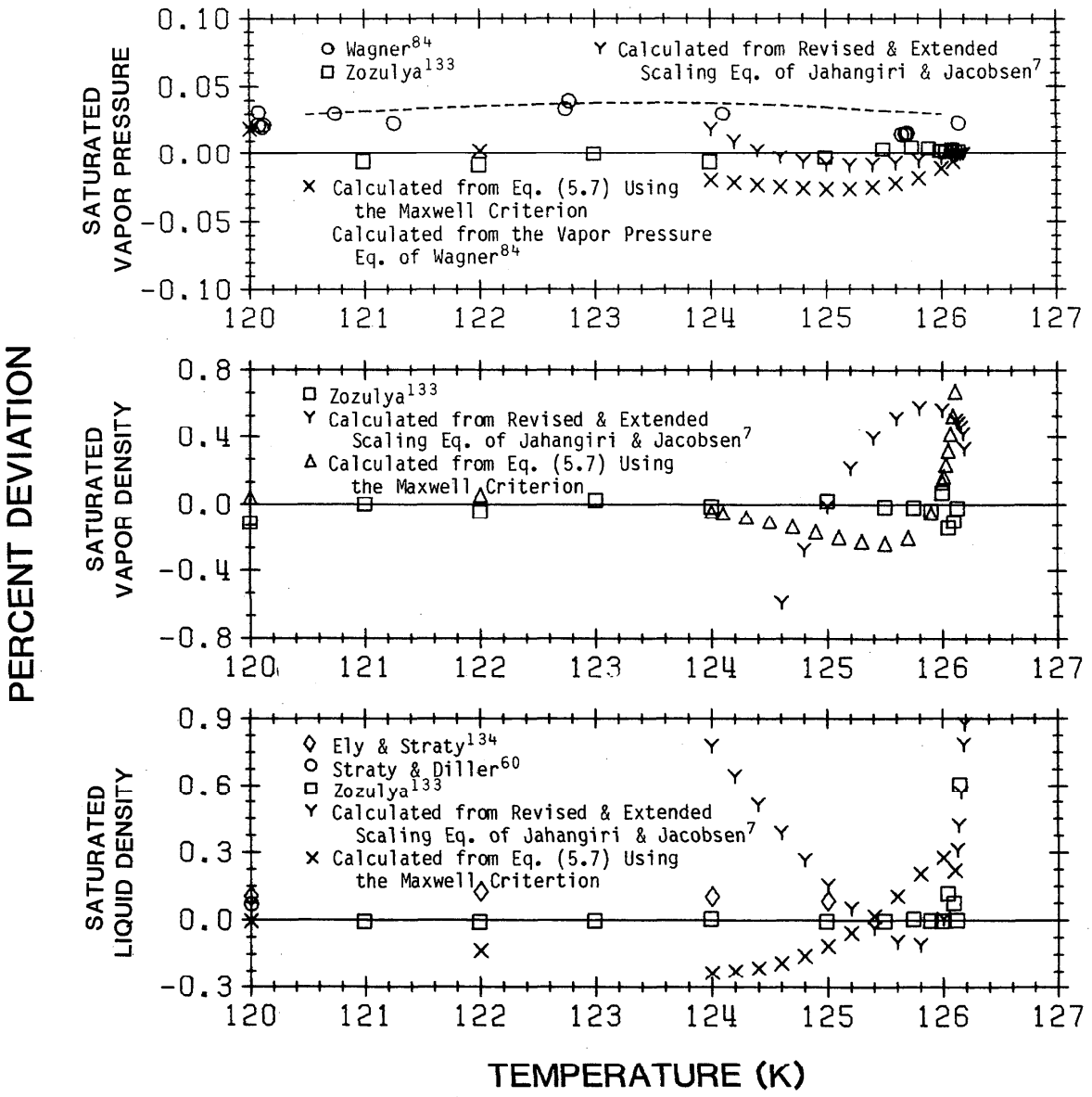

FIG. 27. Comparisons of selected coexistence property data and values calculated from Eq. (5.7) using the Maxwell criterion (equal area principle) with calculated values from Eqs. (3.1), (3.2), and (3.3)—continued.

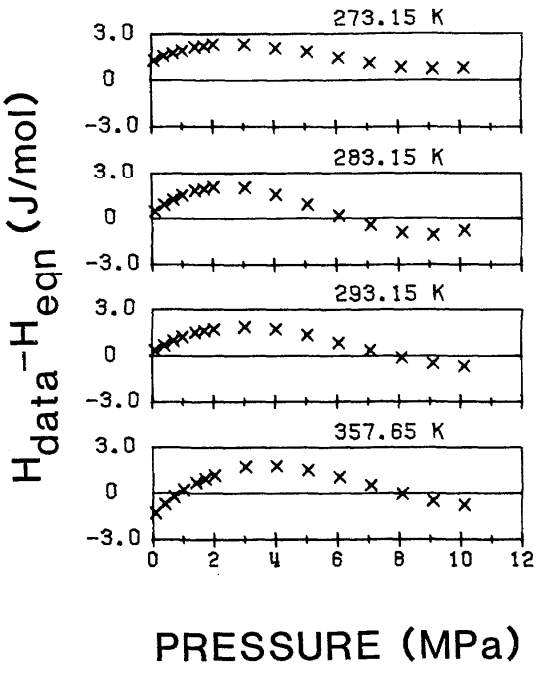

FIG. 28. Comparisons of calculated values of enthalpy to data of Dawe and Snowdon (Ref. 63).

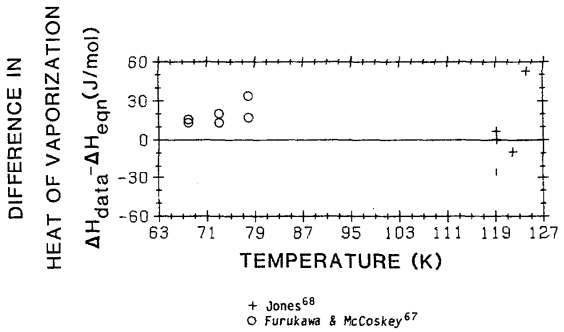

FIG. 29. Comparisons of calculated values of heat of vaporization from Eq. (5.7) to data.

properties at the critical point cannot be properly modeled by an analytical equation of state. Figure 34 illustrates comparisons of calculated derived properties to values calculated from the revised and extended scaling model of Jahangiri and Jacobsen.[7]

6.9. Estimated Accuracy of Calculated Properties

The estimated accuracy of density values calculated with the formulation presented here is $\pm 0.1\%$ except in the near critical region (between 7.5 and 15 mol/dm^3 at temperatures between 124.5 and 140 K). The formulation given here may be expected to give pressures in the critical region with an estimated accuracy of $\pm 0.1\%$. Although this fundamental equation is more accurate than the wide-range equation of state of Jacobsen and Stewart[1] for the calculation of pressures in the critical region, calculated densities may be substantially in error near the critical point. The formulation of Jahangiri and Jacobsen[7] should be used for critical-region properties instead of that presented here.

Based on comparisons to the measured values of C_p, the calculated values of heat capacity (C_p and C_v) are estimated to be accurate to within $\pm 2\%$. Although the comparisons of Sec. 6.2 indicate some deviations of calculated isochoric heat capacity (C_v) values larger than $\pm 5\%$, the overall accuracy is estimated on the basis of comparisons to the data considered most reliable by the authors (those of Weber[95]). Calculated values of velocity of sound are estimated to be accurate to within $\pm 1\%$, except near the critical point. The accuracies of other calculated derived properties may be inferred from those discussed in this section.

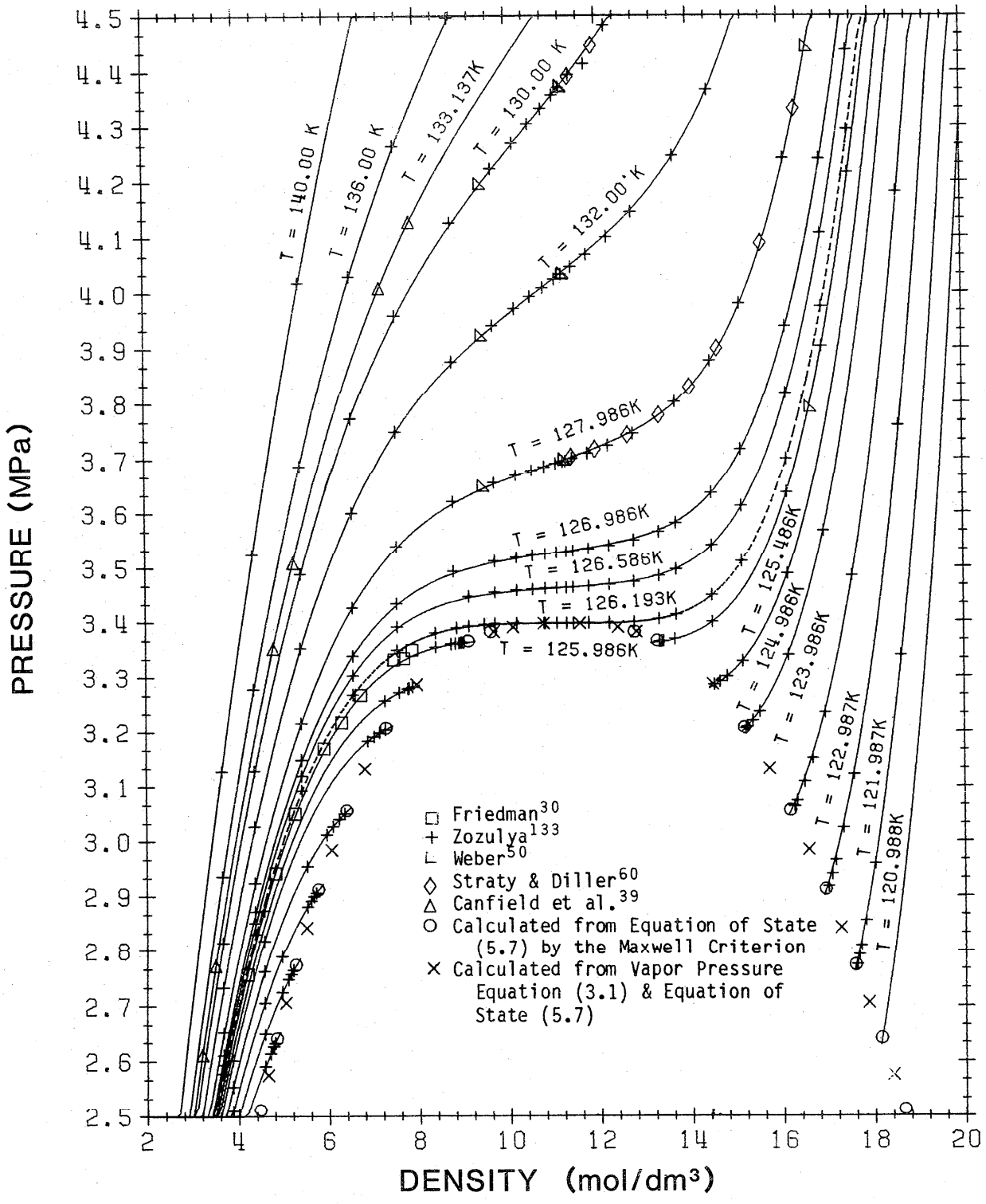

FIG. 30. Comparisons of P-ρ-T data for nitrogen in the critical region.

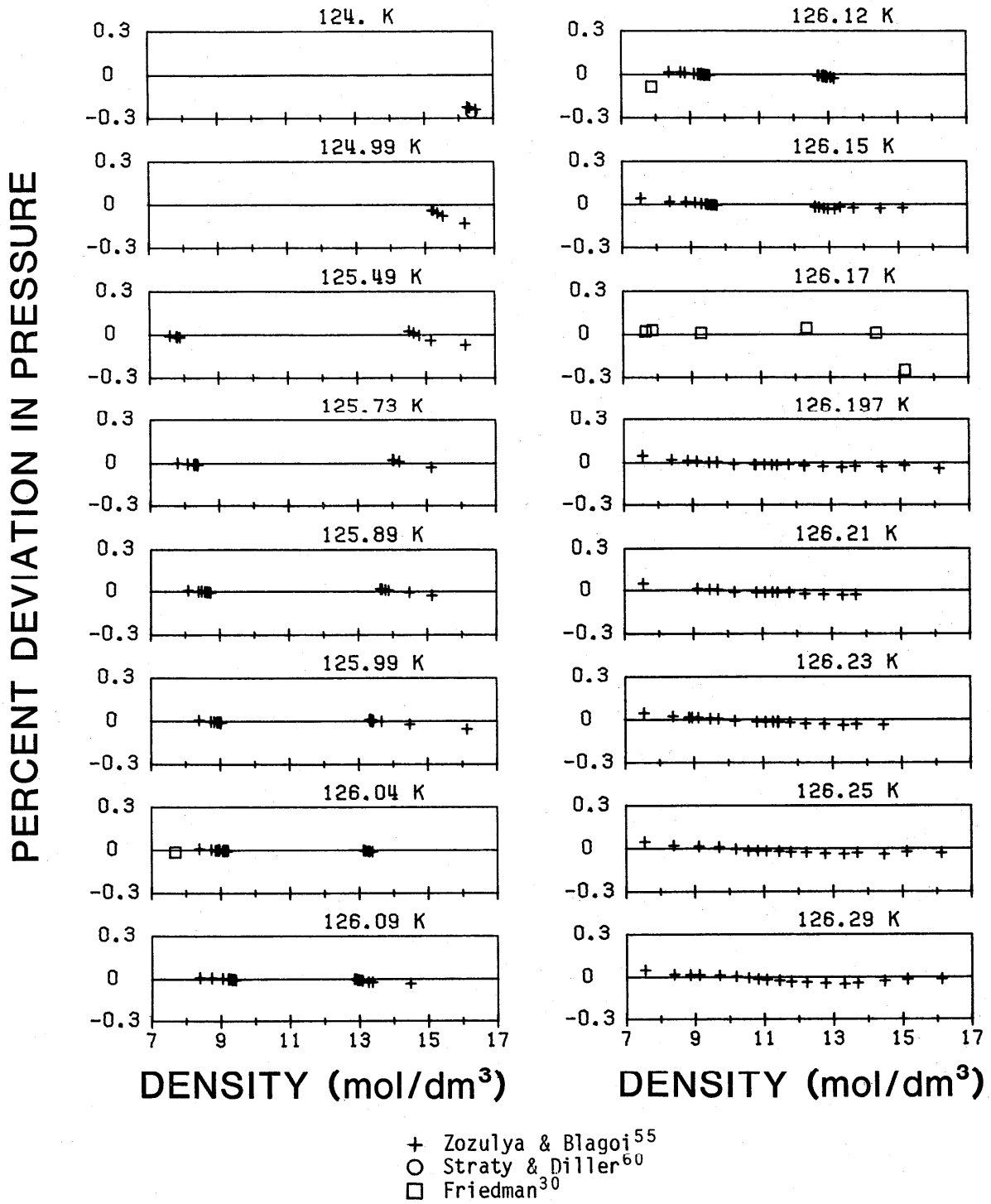

FIG. 31. Comparisons of calculated values of pressure to the experimental data in the critical region.

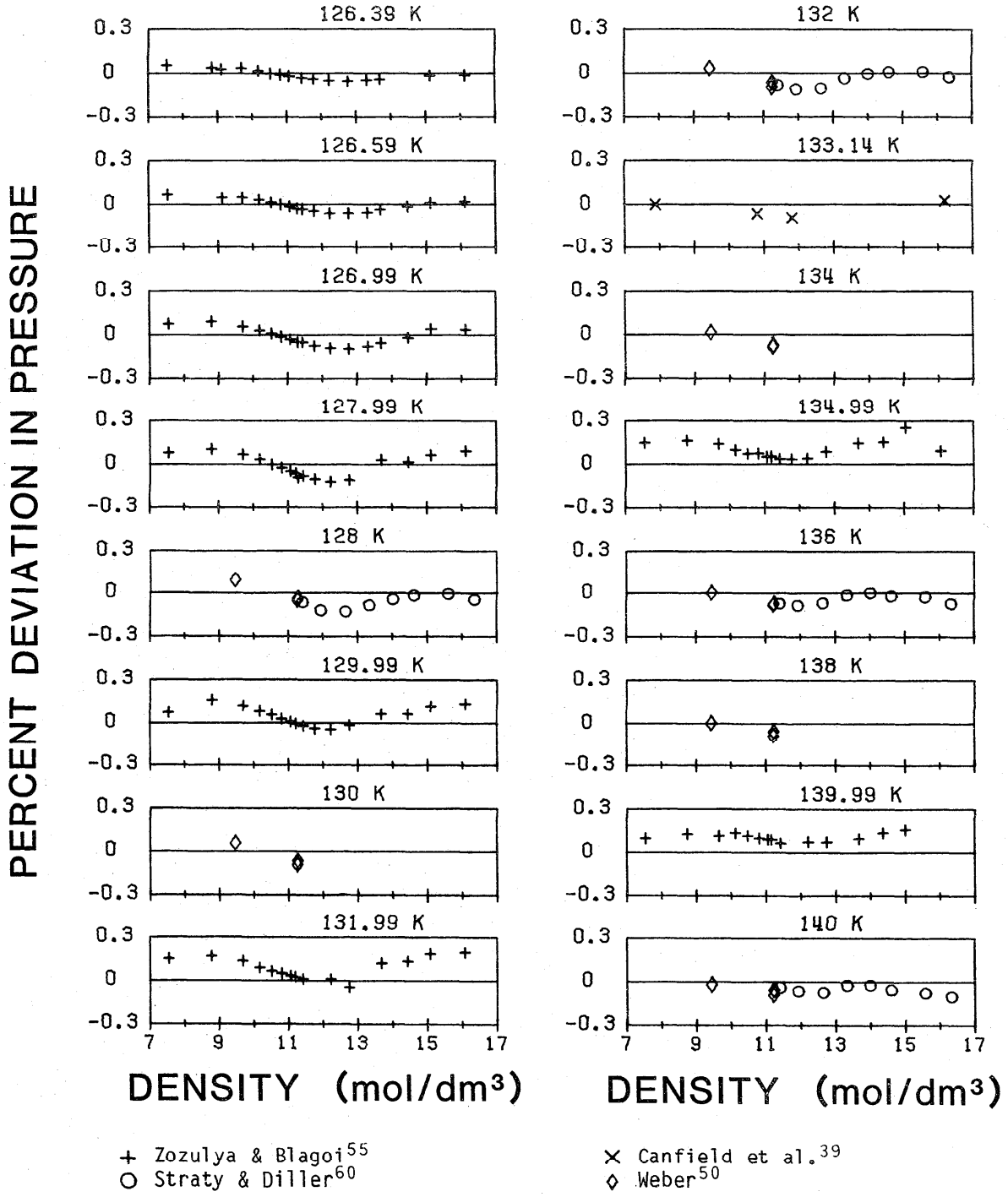

FIG. 31. Comparisons of calculated values of pressure to the experimental data in the critical region—continued.

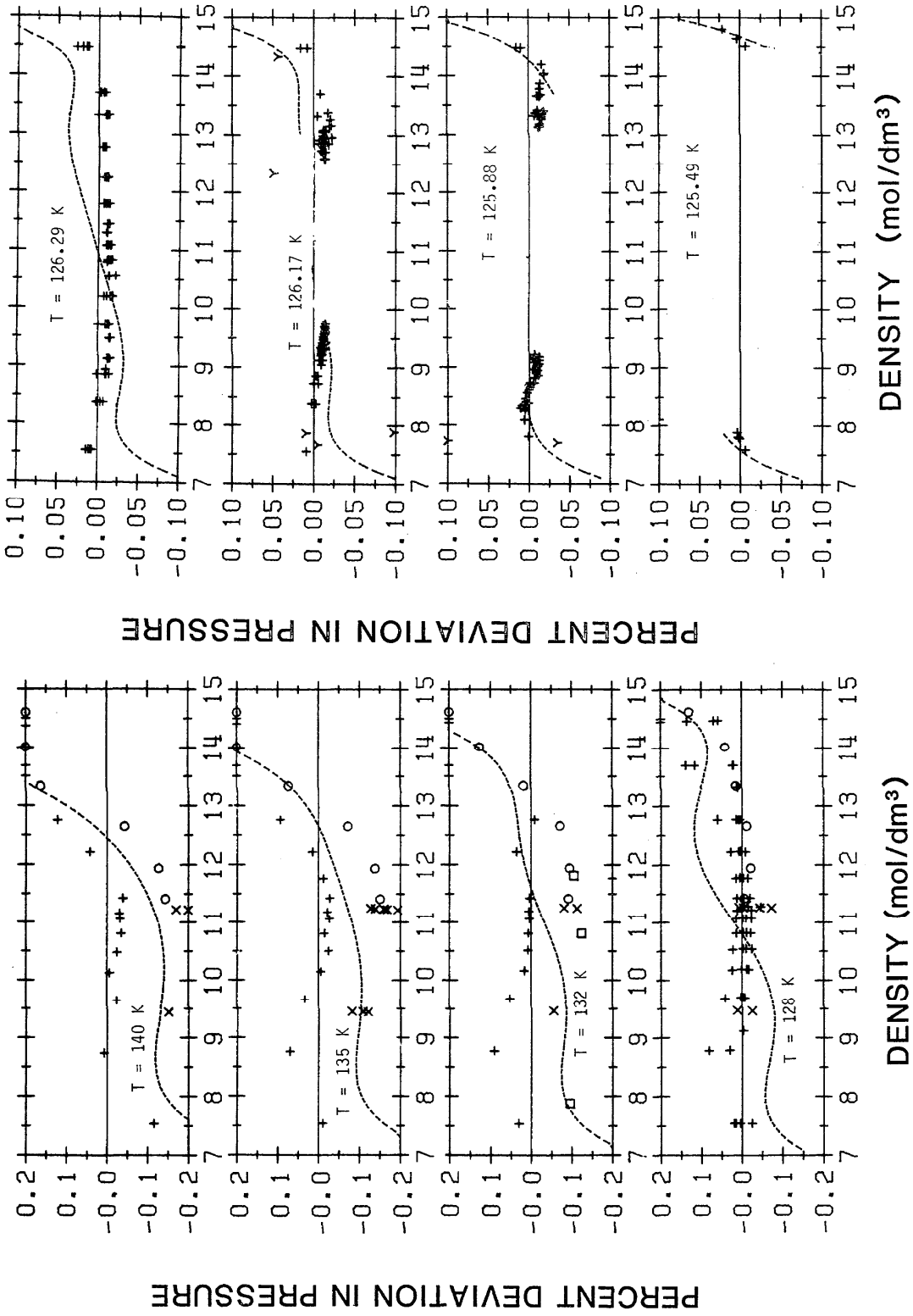

FIG. 32. Pressure deviations of equation of state and P-ρ-T data from the revised and extended scaling equation in the critical region. [The zero deviation line is the formulation of Jahangiri and Jacobsen (Ref. 7).]

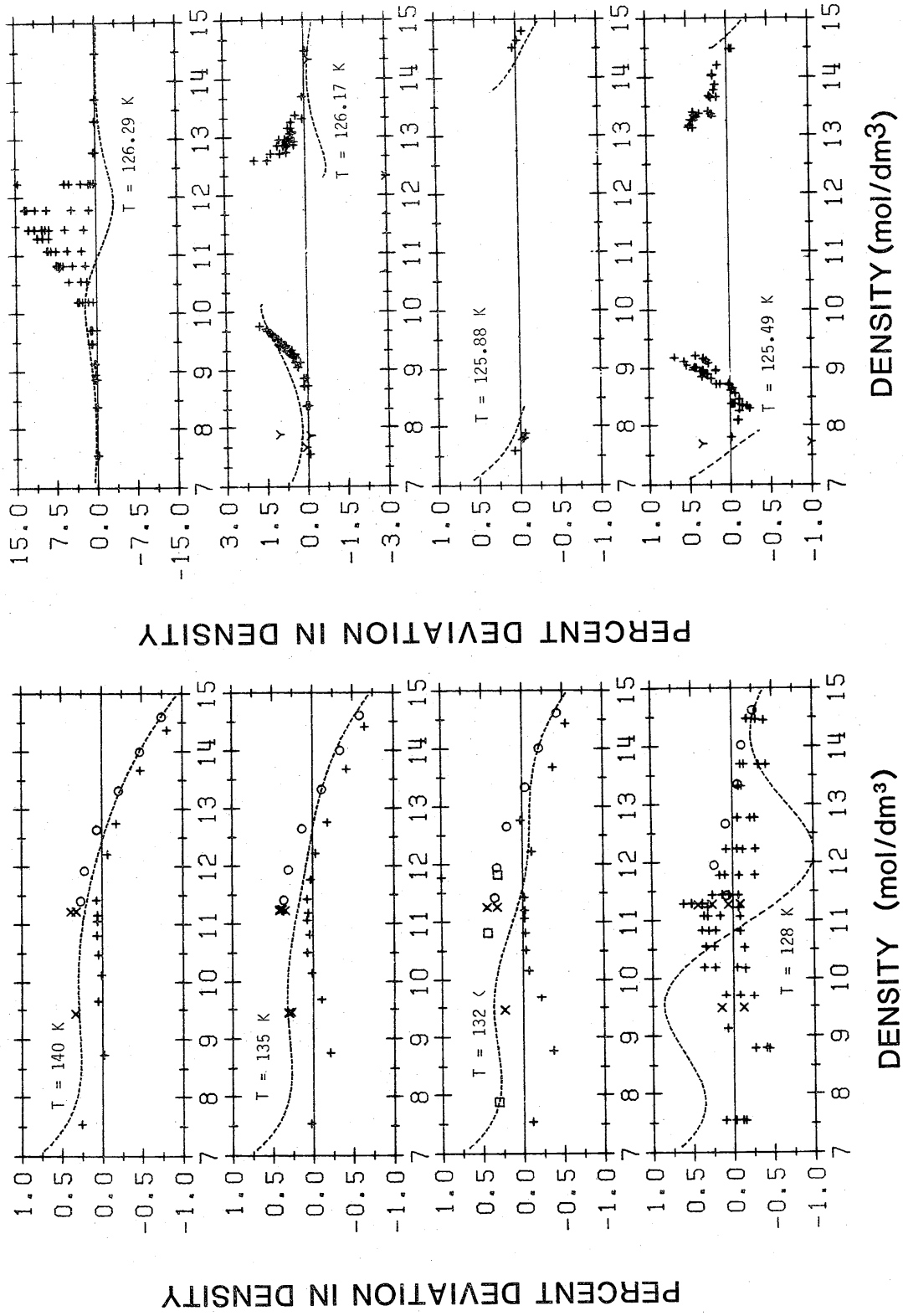

FIG. 33. Density deviations of equation of state and P-ρ-T data from the revised and extended scaling equation in the critical region. [The zero deviation line is the formulation of Jahangiri and Jacobsen (Ref. 7).]

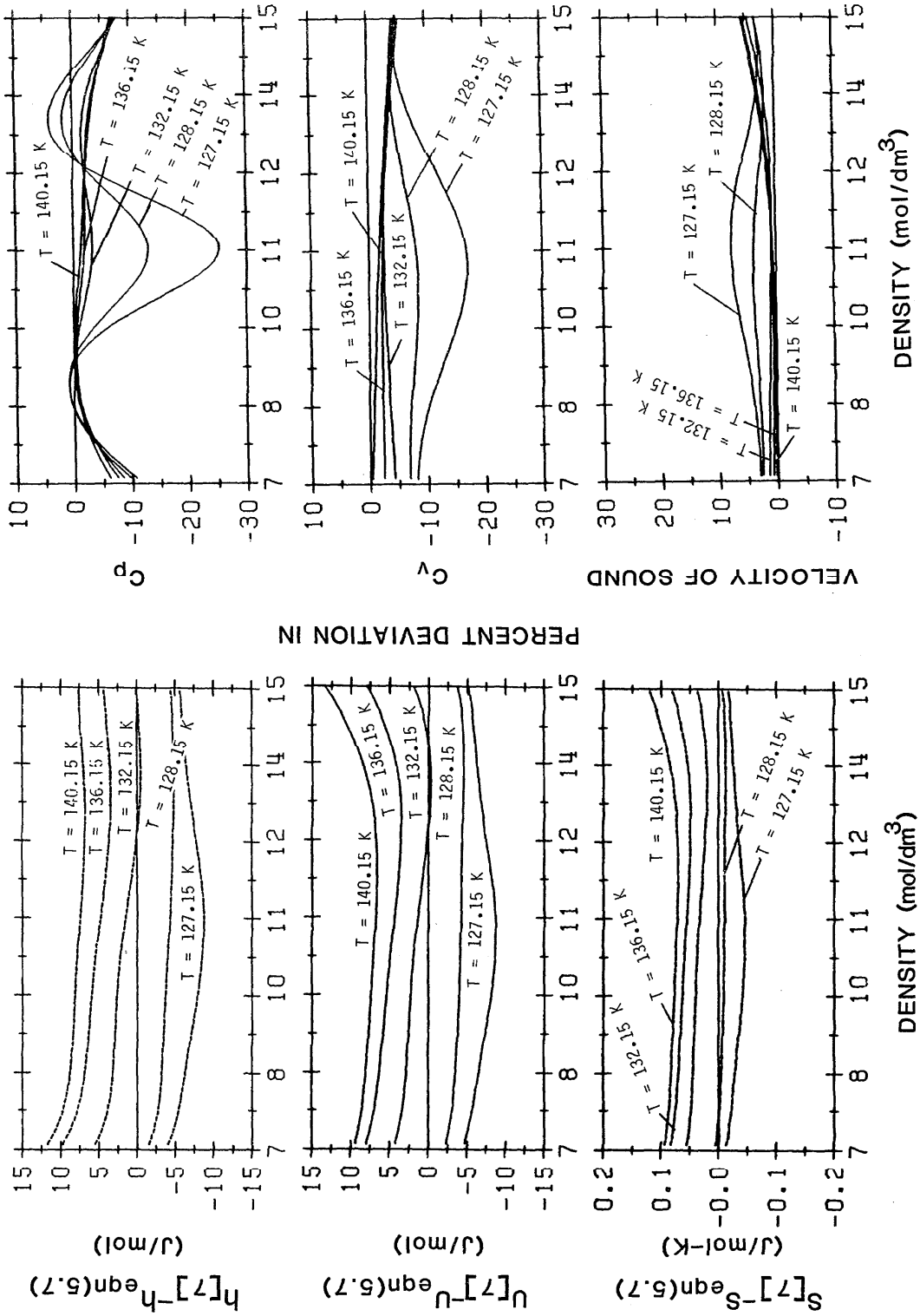

FIG. 34. Comparisons of calculated derived properties from this work (isothermal lines) to values from the scaled formulation (Ref. 7) (base line of plots).

7. Acknowledgments

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Appendix. Thermodynamic Properties of Nitrogen

Saturation entries for isobar tables are calculated using temperatures determined by iterative solution of the vapor pressure Eq. (3.1). The densities for the saturated liquid and vapor are calculated iteratively using the equation of state, Eq. (5.7). Table entries for the liquid–vapor saturation table are calculated using the vapor pressure equation to determine P_σ at the table value of T_σ. Densities and derived properties are calculated using the same methods as those for the saturation entries in the isobar tables.

Table 21. Thermodynamic properties of saturated nitrogen

Temperature K	Pressure MPa	Density mol/dm^3	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
[a]63.15	0.01253	31.046	-4227.5	67.89	31.29	56.56	1022
		0.02412	1806.3	163.43	23.94	33.27	159
64	0.01460	30.915	-4179.3	68.64	31.21	56.49	1010
		0.02776	1828.8	162.52	24.10	33.51	160
65	0.01741	30.760	-4122.8	69.52	31.12	56.43	996
		0.03264	1854.8	161.48	24.30	33.82	161
66	0.02063	30.605	-4066.3	70.38	31.03	56.40	983
		0.03816	1880.6	160.48	24.50	34.12	162
67	0.02432	30.450	-4009.8	71.23	30.93	56.39	970
		0.04439	1906.0	159.52	24.70	34.44	163
68	0.02850	30.294	-3953.4	72.06	30.84	56.39	958
		0.05137	1931.2	158.60	24.88	34.74	164
69	0.03324	30.137	-3896.9	72.88	30.74	56.42	945
		0.05917	1956.0	157.71	25.06	35.05	165
70	0.03857	29.980	-3840.3	73.70	30.64	56.46	933
		0.06784	1980.5	156.85	25.24	35.36	166
71	0.04456	29.821	-3783.7	74.50	30.54	56.52	921
		0.07745	2004.7	156.02	25.41	35.67	167
72	0.05125	29.662	-3727.0	75.29	30.44	56.59	910
		0.08808	2028.5	155.22	25.56	35.97	168
73	0.05870	29.502	-3670.2	76.07	30.34	56.68	898
		0.09978	2051.8	154.45	25.72	36.27	169
74	0.06696	29.341	-3613.3	76.84	30.24	56.78	887
		0.11264	2074.8	153.70	25.86	36.57	170
75	0.07610	29.179	-3556.3	77.60	30.14	56.90	876
		0.12671	2097.3	152.98	25.99	36.87	170
76	0.08617	29.016	-3499.1	78.35	30.04	57.02	864
		0.14208	2119.3	152.28	26.12	37.17	171
77	0.09723	28.852	-3441.8	79.09	29.94	57.16	853
		0.15881	2140.9	151.60	26.23	37.46	172
78	0.10935	28.686	-3384.3	79.83	29.83	57.31	842
		0.17699	2162.0	150.94	26.34	37.75	173
79	0.12258	28.520	-3326.7	80.56	29.73	57.48	832
		0.19670	2182.6	150.30	26.43	38.04	173
80	0.13699	28.351	-3268.9	81.28	29.63	57.65	821
		0.21801	2202.7	149.67	26.52	38.34	174

Table 21. Thermodynamic properties of saturated nitrogen–Continued

Temperature K	Pressure MPa	Density mol/dm^3	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
81	0.15265	28.182	-3210.8	81.99	29.53	57.84	810
		0.24100	2222.2	149.07	26.60	38.63	175
82	0.16961	28.011	-3152.6	82.70	29.42	58.04	799
		0.26578	2241.1	148.48	26.67	38.92	175
83	0.18795	27.838	-3094.1	83.40	29.32	58.26	788
		0.29242	2259.5	147.90	26.73	39.22	176
84	0.20773	27.664	-3035.4	84.10	29.22	58.48	778
		0.32102	2277.2	147.34	26.78	39.52	176
85	0.22903	27.488	-2976.5	84.78	29.12	58.72	767
		0.35169	2294.2	146.79	26.83	39.84	177
86	0.25191	27.310	-2917.3	85.47	29.02	58.98	756
		0.38451	2310.6	146.26	26.88	40.16	177
87	0.27644	27.131	-2857.8	86.14	28.92	59.26	746
		0.41961	2326.3	145.73	26.92	40.49	178
88	0.30270	26.950	-2798.0	86.82	28.83	59.55	735
		0.45709	2341.2	145.22	26.95	40.84	178
89	0.33074	26.766	-2737.9	87.48	28.73	59.86	724
		0.49707	2355.4	144.71	26.99	41.21	179
90	0.36066	26.581	-2677.4	88.15	28.64	60.18	713
		0.53967	2368.8	144.22	27.02	41.59	179
91	0.39252	26.393	-2616.7	88.80	28.55	60.54	702
		0.58503	2381.4	143.73	27.05	42.01	179
92	0.42639	26.203	-2555.5	89.46	28.46	60.91	692
		0.63329	2393.1	143.25	27.08	42.44	180
93	0.46235	26.011	-2494.0	90.11	28.37	61.31	681
		0.68459	2403.9	142.78	27.11	42.91	180
94	0.50047	25.816	-2432.1	90.76	28.29	61.74	670
		0.73909	2413.8	142.31	27.14	43.42	180
95	0.54082	25.619	-2369.7	91.40	28.21	62.20	658
		0.79696	2422.6	141.85	27.18	43.96	180
96	0.58349	25.418	-2306.9	92.04	28.13	62.69	647
		0.85838	2430.5	141.39	27.22	44.55	180
97	0.62855	25.215	-2243.6	92.68	28.05	63.22	636
		0.92353	2437.4	140.94	27.26	45.19	181
98	0.67607	25.008	-2179.8	93.31	27.98	63.79	624
		0.99262	2443.1	140.49	27.31	45.88	181

Table 21 Thermodynamic properties of saturated nitrogen—Continued

Temperature K	Pressure MPa	Density mol/dm^3	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
99	0.72613	24.798	-2115.5	93.94	27.91	64.41	613
		1.0659	2447.6	140.04	27.36	46.63	181
100	0.77881	24.584	-2050.5	94.58	27.84	65.09	601
		1.1436	2451.0	139.59	27.43	47.46	181
101	0.83419	24.367	-1985.0	95.21	27.78	65.82	589
		1.2259	2453.0	139.15	27.49	48.36	181
102	0.89234	24.145	-1918.7	95.83	27.73	66.61	577
		1.3132	2453.8	138.70	27.57	49.35	181
103	0.95334	23.919	-1851.8	96.46	27.68	67.49	565
		1.4058	2453.1	138.26	27.65	50.44	180
104	1.0173	23.688	-1784.1	97.09	27.64	68.44	552
		1.5041	2451.0	137.81	27.75	51.65	180
105	1.0842	23.452	-1715.5	97.72	27.60	69.50	540
		1.6083	2447.2	137.37	27.85	52.98	180
106	1.1543	23.210	-1646.0	98.35	27.57	70.67	527
		1.7191	2441.9	136.92	27.97	54.47	180
107	1.2275	22.961	-1575.5	98.98	27.55	71.97	514
		1.8368	2434.7	136.46	28.10	56.13	180
108	1.3040	22.706	-1504.0	99.62	27.54	73.42	500
		1.9620	2425.6	136.00	28.24	57.98	179
109	1.3839	22.443	-1431.2	100.25	27.54	75.06	487
		2.0954	2414.6	135.54	28.40	60.08	179
110	1.4672	22.172	-1357.1	100.90	27.55	76.90	473
		2.2377	2401.3	135.07	28.57	62.45	178
111	1.5540	21.892	-1281.6	101.54	27.57	79.01	458
		2.3898	2385.6	134.58	28.76	65.15	178
112	1.6445	21.600	-1204.5	102.20	27.61	81.42	444
		2.5527	2367.4	134.09	28.97	68.26	177
113	1.7387	21.297	-1125.5	102.86	27.67	84.21	429
		2.7275	2346.3	133.59	29.21	71.87	177
114	1.8367	20.981	-1044.5	103.54	27.75	87.48	413
		2.9156	2322.1	133.07	29.46	76.09	176
115	1.9387	20.649	-961.08	104.22	27.86	91.34	397
		3.1189	2294.4	132.53	29.75	81.10	175
116	2.0448	20.299	-875.01	104.92	28.00	95.97	381
		3.3395	2262.7	131.97	30.06	87.12	175

Table 21. Thermodynamic properties of saturated nitrogen—Continued

Temperature K	Pressure MPa	Density mol/dm^3	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
117	2.1551	19.927	-785.81	105.64	28.18	101.6	364
		3.5800	2226.5	131.39	30.42	94.49	174
118	2.2697	19.531	-692.94	106.38	28.40	108.6	346
		3.8441	2185.0	130.77	30.81	103.7	173
119	2.3888	19.105	-595.71	107.15	28.69	117.4	328
		4.1363	2137.3	130.12	31.26	115.5	172
120	2.5125	18.643	-493.19	107.95	29.06	128.9	309
		4.4632	2082.1	129.41	31.78	131.2	171
121	2.6410	18.135	-384.13	108.80	29.54	144.6	289
		4.8339	2017.4	128.65	32.38	153.0	170
122	2.7747	17.569	-266.70	109.70	30.16	167.1	269
		5.2630	1940.3	127.79	33.09	185.4	169
123	2.9136	16.924	-137.89	110.69	30.99	202.9	248
		5.7748	1846.0	126.82	33.96	238.2	167
124	3.0582	16.160	8.17	111.80	32.14	269.9	225
		6.4168	1724.9	125.65	35.08	340.3	165
125	3.2089	15.170	187.04	113.16	33.88	450.3	200
		7.3111	1553.0	124.09	36.66	620.2	163
126	3.3664	13.304	495.38	115.53	37.66		168
		9.1698	1194.9	121.08	39.64		159
[b]126.19	3.3978	11.177	834.55	118.20			

[a] Triple point
[b] Critical point

Table 22. Thermodynamic properties of nitrogen

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
			0.02 MPa Isobar				
* 63.15	31.047	-4227.9	-4227.3	67.89	31.29	56.56	1022
64	30.915	-4179.8	-4179.2	68.64	31.22	56.49	1010
* 65.81	30.634	-4077.4	-4076.8	70.22	31.04	56.40	986
* 65.81	0.03709	1336.5	1875.8	160.67	24.47	34.07	162
66	0.03697	1341.2	1882.1	160.76	24.23	33.77	163
68	0.03581	1388.7	1947.2	161.73	22.52	31.57	166
70	0.03474	1433.4	2009.1	162.63	21.69	30.50	169
72	0.03374	1476.7	2069.5	163.48	21.27	29.96	172
74	0.03280	1519.4	2129.2	164.30	21.06	29.68	174
76	0.03191	1561.7	2188.4	165.09	20.95	29.53	177
78	0.03108	1603.8	2247.3	165.85	20.90	29.44	179
80	0.03028	1645.7	2306.1	166.60	20.86	29.39	182
82	0.02953	1687.7	2364.9	167.32	20.85	29.36	184
84	0.02882	1729.5	2423.6	168.03	20.84	29.33	186
86	0.02813	1771.4	2482.2	168.72	20.83	29.32	188
88	0.02749	1813.2	2540.9	169.40	20.83	29.30	191
90	0.02687	1855.0	2599.5	170.05	20.83	29.29	193
92	0.02627	1896.8	2658.0	170.70	20.82	29.28	195
94	0.02571	1938.6	2716.6	171.33	20.82	29.27	197
96	0.02517	1980.4	2775.1	171.94	20.82	29.26	199
98	0.02465	2022.1	2833.6	172.55	20.82	29.26	201
100	0.02415	2063.9	2892.1	173.14	20.82	29.25	203
102	0.02367	2105.6	2950.6	173.72	20.82	29.24	205
104	0.02321	2147.4	3009.1	174.28	20.82	29.24	207
106	0.02277	2189.1	3067.6	174.84	20.82	29.23	210
108	0.02234	2230.8	3126.0	175.39	20.81	29.22	211
110	0.02193	2272.6	3184.5	175.92	20.81	29.22	213
112	0.02154	2314.3	3242.9	176.45	20.81	29.21	215
114	0.02116	2356.0	3301.3	176.97	20.81	29.21	217
116	0.02079	2397.7	3359.7	177.48	20.81	29.20	219
118	0.02043	2439.4	3418.1	177.97	20.81	29.20	221
120	0.02009	2481.1	3476.5	178.46	20.81	29.20	223
122	0.01976	2522.8	3534.9	178.95	20.81	29.19	225
124	0.01944	2564.5	3593.3	179.42	20.81	29.19	227
126	0.01913	2606.1	3651.7	179.89	20.81	29.19	229
128	0.01883	2647.8	3710.1	180.35	20.81	29.18	230
130	0.01854	2689.5	3768.4	180.80	20.81	29.18	232
132	0.01825	2731.2	3826.8	181.25	20.81	29.18	234
134	0.01798	2772.8	3885.1	181.69	20.80	29.17	236
136	0.01772	2814.5	3943.5	182.12	20.80	29.17	238

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
138	0.01746	2856.1	4001.8	182.54	20.80	29.17	239
140	0.01721	2897.8	4060.1	182.96	20.80	29.17	241
142	0.01696	2939.5	4118.5	183.38	20.80	29.16	243
144	0.01673	2981.1	4176.8	183.78	20.80	29.16	244
146	0.01650	3022.8	4235.1	184.19	20.80	29.16	246
148	0.01627	3064.4	4293.4	184.58	20.80	29.16	248
150	0.01606	3106.1	4351.8	184.98	20.80	29.16	250
155	0.01554	3210.2	4497.5	185.93	20.80	29.15	254
160	0.01505	3314.2	4643.3	186.86	20.80	29.15	258
165	0.01459	3418.3	4789.0	187.75	20.80	29.15	262
170	0.01416	3522.4	4934.8	188.62	20.80	29.14	266
175	0.01376	3626.5	5080.5	189.47	20.80	29.14	270
180	0.01337	3730.5	5226.2	190.29	20.80	29.14	273
185	0.01301	3834.6	5371.8	191.09	20.80	29.14	277
190	0.01267	3938.6	5517.5	191.86	20.80	29.13	281
195	0.01234	4042.7	5663.2	192.62	20.80	29.13	285
200	0.01203	4146.7	5808.9	193.36	20.80	29.13	288
210	0.01146	4354.8	6100.2	194.78	20.80	29.13	295
220	0.01094	4562.8	6391.5	196.14	20.80	29.13	302
230	0.01046	4770.9	6682.7	197.43	20.80	29.13	309
240	0.01002	4978.9	6974.0	198.67	20.80	29.13	316
250	0.00962	5187.0	7265.2	199.86	20.80	29.13	322
260	0.00925	5395.0	7556.5	201.00	20.80	29.13	329
270	0.00891	5603.1	7847.7	202.10	20.80	29.13	335
280	0.00859	5811.2	8139.0	203.16	20.80	29.13	341
290	0.00830	6019.3	8430.3	204.18	20.81	29.13	347
300	0.00802	6227.4	8721.6	205.17	20.81	29.13	353
310	0.00776	6435.6	9013.0	206.12	20.82	29.14	359
320	0.00752	6643.8	9304.4	207.05	20.82	29.14	365
330	0.00729	6852.2	9595.9	207.95	20.83	29.15	370
340	0.00707	7060.5	9887.5	208.82	20.84	29.16	376
350	0.00687	7269.0	10179.	209.66	20.85	29.17	381
360	0.00668	7477.6	10471.	210.48	20.86	29.18	387
370	0.00650	7686.4	10763.	211.28	20.88	29.20	392
380	0.00633	7895.3	11055.	212.06	20.90	29.21	397
390	0.00617	8104.3	11347.	212.82	20.91	29.23	402
400	0.00601	8313.6	11640.	213.56	20.93	29.25	407
420	0.00573	8732.8	12225.	214.99	20.98	29.30	417
440	0.00547	9153.0	12812.	216.36	21.04	29.36	427
460	0.00523	9574.5	13399.	217.66	21.11	29.42	436
480	0.00501	9997.4	13989.	218.92	21.18	29.50	445
500	0.00481	10422.	14579.	220.12	21.27	29.58	454
520	0.00463	10848.	15172.	221.28	21.36	29.67	463
540	0.00445	11276.	15766.	222.41	21.46	29.77	472
560	0.00430	11707.	16363.	223.49	21.56	29.88	480

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
580	0.00415	12139.	16962.	224.54	21.68	29.99	488
600	0.00401	12574.	17563.	225.56	21.80	30.11	496
620	0.00388	13011.	18166.	226.55	21.92	30.23	504
640	0.00376	13451.	18772.	227.51	22.05	30.36	512
660	0.00364	13893.	19381.	228.45	22.17	30.49	519
680	0.00354	14338.	19992.	229.36	22.31	30.62	526
700	0.00344	14785.	20606.	230.25	22.44	30.76	534
720	0.00334	15235.	21222.	231.12	22.58	30.89	541
740	0.00325	15688.	21841.	231.97	22.71	31.03	548
760	0.00316	16144.	22463.	232.79	22.85	31.16	555
780	0.00308	16602.	23088.	233.61	22.98	31.30	562
800	0.00301	17063.	23715.	234.40	23.12	31.44	568
850	0.00283	18228.	25295.	236.32	23.45	31.77	585
900	0.00267	19408.	26892.	238.14	23.78	32.09	600
950	0.00253	20605.	28504.	239.88	24.09	32.40	616
1000	0.00241	21817.	30132.	241.55	24.38	32.70	631
1050	0.00229	23043.	31774.	243.16	24.66	32.98	646
1100	0.00219	24283.	33429.	244.70	24.93	33.24	660
1150	0.00209	25536.	35098.	246.18	25.18	33.49	674
1200	0.00200	26800.	36778.	247.61	25.41	33.72	688
1250	0.00192	28076.	38470.	248.99	25.63	33.94	701
1300	0.00185	29363.	40172.	250.33	25.83	34.15	714
1350	0.00178	30660.	41885.	251.62	26.02	34.34	727
1400	0.00172	31965.	43606.	252.87	26.20	34.52	740
1450	0.00166	33280.	45336.	254.09	26.37	34.69	752
1500	0.00160	34602.	47075.	255.26	26.53	34.84	765
1550	0.00155	35933.	48820.	256.41	26.68	34.99	777
1600	0.00150	37270.	50573.	257.52	26.81	35.13	789
1650	0.00146	38614.	52333.	258.60	26.94	35.26	801
1700	0.00141	39964.	54099.	259.66	27.07	35.38	812
1750	0.00137	41320.	55871.	260.69	27.18	35.49	824
1800	0.00134	42682.	57649.	261.69	27.29	35.60	835
1850	0.00130	44049.	59431.	262.66	27.39	35.70	846
1900	0.00127	45421.	61219.	263.62	27.49	35.80	857
1950	0.00123	46798.	63011.	264.55	27.58	35.89	868
2000	0.00120	48179.	64808.	265.46	27.66	35.98	879
			0.04 MPa Isobar				
* 63.15	31.048	-4228.0	-4226.7	67.89	31.30	56.56	1022
64	30.917	-4180.0	-4178.8	68.64	31.22	56.49	1010
66	30.607	-4067.2	-4065.9	70.38	31.03	56.40	983
68	30.294	-3954.4	-3953.1	72.06	30.84	56.39	958

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
70	29.980	-3841.6	-3840.3	73.70	30.64	56.46	933
* 70.25	29.940	-3827.6	-3826.2	73.90	30.62	56.48	930
* 70.25	0.07014	1416.3	1986.6	156.64	25.28	35.44	166
72	0.06824	1460.0	2046.2	157.48	23.32	32.87	170
74	0.06625	1506.4	2110.2	158.36	22.15	31.33	173
76	0.06439	1550.8	2172.0	159.18	21.55	30.53	176
78	0.06266	1594.1	2232.5	159.97	21.24	30.10	178
80	0.06102	1636.9	2292.5	160.72	21.07	29.86	181
82	0.05947	1679.4	2352.0	161.46	20.98	29.72	183
84	0.05800	1721.7	2411.4	162.17	20.93	29.63	185
86	0.05661	1763.9	2470.6	162.87	20.90	29.57	188
88	0.05528	1806.1	2529.7	163.55	20.88	29.53	190
90	0.05401	1848.2	2588.7	164.21	20.87	29.50	192
92	0.05281	1890.2	2647.7	164.86	20.87	29.47	194
94	0.05165	1932.2	2706.6	165.50	20.86	29.45	197
96	0.05055	1974.2	2765.5	166.12	20.86	29.43	199
98	0.04949	2016.2	2824.3	166.72	20.85	29.41	201
100	0.04848	2058.1	2883.1	167.32	20.85	29.40	203
102	0.04751	2100.0	2941.9	167.90	20.85	29.38	205
104	0.04658	2141.9	3000.7	168.47	20.84	29.37	207
106	0.04568	2183.8	3059.4	169.03	20.84	29.36	209
108	0.04482	2225.7	3118.1	169.58	20.84	29.35	211
110	0.04399	2267.6	3176.8	170.12	20.84	29.34	213
112	0.04320	2309.4	3235.4	170.64	20.84	29.32	215
114	0.04243	2351.3	3294.1	171.16	20.83	29.32	217
116	0.04168	2393.1	3352.7	171.67	20.83	29.31	219
118	0.04097	2434.9	3411.3	172.17	20.83	29.30	221
120	0.04027	2476.7	3469.9	172.67	20.83	29.29	223
122	0.03961	2518.5	3528.5	173.15	20.83	29.28	225
124	0.03896	2560.3	3587.0	173.63	20.83	29.27	227
126	0.03833	2602.1	3645.6	174.09	20.82	29.27	228
128	0.03773	2643.9	3704.1	174.55	20.82	29.26	230
130	0.03714	2685.6	3762.6	175.01	20.82	29.25	232
132	0.03657	2727.4	3821.1	175.46	20.82	29.25	234
134	0.03602	2769.1	3879.6	175.89	20.82	29.24	236
136	0.03549	2810.9	3938.1	176.33	20.82	29.24	237
138	0.03497	2852.6	3996.6	176.75	20.82	29.23	239
140	0.03446	2894.4	4055.0	177.18	20.82	29.23	241
142	0.03397	2936.1	4113.5	177.59	20.81	29.22	243
144	0.03350	2977.8	4171.9	178.00	20.81	29.22	244
146	0.03304	3019.5	4230.4	178.40	20.81	29.22	246
148	0.03259	3061.2	4288.8	178.80	20.81	29.21	248
150	0.03215	3103.0	4347.2	179.19	20.81	29.21	249
155	0.03110	3207.2	4493.2	180.15	20.81	29.20	254
160	0.03013	3311.4	4639.2	181.08	20.81	29.19	258

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
165	0.02921	3415.6	4785.2	181.97	20.81	29.19	262
170	0.02834	3519.8	4931.1	182.85	20.81	29.18	266
175	0.02753	3624.0	5077.0	183.69	20.81	29.18	270
180	0.02676	3728.2	5222.8	184.51	20.80	29.17	273
185	0.02604	3832.3	5368.7	185.31	20.80	29.17	277
190	0.02535	3936.4	5514.5	186.09	20.80	29.16	281
195	0.02470	4040.6	5660.3	186.85	20.80	29.16	285
200	0.02408	4144.7	5806.1	187.59	20.80	29.16	288
210	0.02293	4352.9	6097.7	189.01	20.80	29.15	295
220	0.02188	4561.1	6389.1	190.36	20.80	29.15	302
230	0.02093	4769.2	6680.6	191.66	20.80	29.14	309
240	0.02005	4977.4	6972.0	192.90	20.80	29.14	316
250	0.01925	5185.5	7263.4	194.09	20.80	29.14	322
260	0.01851	5393.6	7554.8	195.23	20.80	29.14	329
270	0.01782	5601.8	7846.2	196.33	20.80	29.14	335
280	0.01718	5809.9	8137.6	197.39	20.81	29.14	341
290	0.01659	6018.1	8429.0	198.41	20.81	29.14	347
300	0.01604	6226.3	8720.4	199.40	20.81	29.14	353
310	0.01552	6434.5	9011.8	200.36	20.82	29.15	359
320	0.01503	6642.8	9303.3	201.28	20.82	29.15	365
330	0.01458	6851.1	9594.9	202.18	20.83	29.16	370
340	0.01415	7059.6	9886.5	203.05	20.84	29.17	376
350	0.01375	7268.1	10178.	203.90	20.85	29.18	381
360	0.01336	7476.7	10470.	204.72	20.87	29.19	387
370	0.01300	7685.5	10762.	205.52	20.88	29.20	392
380	0.01266	7894.4	11054.	206.30	20.90	29.22	397
390	0.01233	8103.5	11346.	207.06	20.91	29.24	402
400	0.01203	8312.8	11639.	207.80	20.94	29.26	407
420	0.01145	8732.1	12225.	209.23	20.98	29.30	417
440	0.01093	9152.4	12811.	210.59	21.04	29.36	427
460	0.01046	9573.9	13399.	211.90	21.11	29.43	436
480	0.01002	9996.8	13988.	213.15	21.18	29.50	446
500	0.00962	10421.	14579.	214.36	21.27	29.59	454
520	0.00925	10848.	15172.	215.52	21.36	29.68	463
540	0.00891	11276.	15766.	216.64	21.46	29.78	472
560	0.00859	11706.	16363.	217.73	21.57	29.88	480
580	0.00829	12139.	16962.	218.78	21.68	30.00	488
600	0.00802	12573.	17563.	219.80	21.80	30.11	496
620	0.00776	13010.	18166.	220.78	21.92	30.24	504
640	0.00752	13450.	18772.	221.75	22.05	30.36	512
660	0.00729	13892.	19381.	222.68	22.18	30.49	519
680	0.00707	14337.	19992.	223.60	22.31	30.62	526
700	0.00687	14785.	20606.	224.48	22.44	30.76	534
720	0.00668	15235.	21222.	225.35	22.58	30.89	541
740	0.00650	15688.	21841.	226.20	22.71	31.03	548

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
760	0.00633	16143.	22463.	227.03	22.85	31.16	555
780	0.00617	16602.	23088.	227.84	22.98	31.30	562
800	0.00601	17063.	23715.	228.64	23.12	31.44	568
850	0.00566	18227.	25296.	230.55	23.45	31.77	585
900	0.00534	19408.	26892.	232.38	23.78	32.09	601
950	0.00506	20605.	28505.	234.12	24.09	32.40	616
1000	0.00481	21817.	30132.	235.79	24.38	32.70	631
1050	0.00458	23043.	31774.	237.39	24.66	32.98	646
1100	0.00437	24283.	33430.	238.93	24.93	33.24	660
1150	0.00418	25536.	35098.	240.42	25.18	33.49	674
1200	0.00401	26800.	36779.	241.85	25.41	33.72	688
1250	0.00385	28076.	38471.	243.23	25.63	33.94	701
1300	0.00370	29363.	40173.	244.56	25.83	34.15	714
1350	0.00356	30660.	41885.	245.86	26.03	34.34	727
1400	0.00344	31965.	43607.	247.11	26.20	34.52	740
1450	0.00332	33280.	45337.	248.32	26.37	34.69	752
1500	0.00321	34602.	47075.	249.50	26.53	34.84	765
1550	0.00310	35933.	48821.	250.65	26.68	34.99	777
1600	0.00301	37270.	50574.	251.76	26.81	35.13	789
1650	0.00292	38614.	52334.	252.84	26.94	35.26	801
1700	0.00283	39964.	54100.	253.90	27.07	35.38	812
1750	0.00275	41320.	55872.	254.92	27.18	35.50	824
1800	0.00267	42682.	57649.	255.92	27.29	35.60	835
1850	0.00260	44049.	59432.	256.90	27.39	35.70	846
1900	0.00253	45421.	61220.	257.86	27.49	35.80	857
1950	0.00247	46798.	63012.	258.79	27.58	35.89	868
2000	0.00241	48179.	64809.	259.70	27.66	35.98	879
			0.06 MPa Isobar				
* 63.15	31.048	-4228.0	-4226.1	67.88	31.30	56.56	1022
64	30.918	-4180.3	-4178.3	68.64	31.22	56.49	1010
66	30.608	-4067.4	-4065.5	70.37	31.03	56.39	983
68	30.296	-3954.7	-3952.7	72.06	30.84	56.39	958
70	29.981	-3841.9	-3839.9	73.69	30.64	56.46	934
72	29.663	-3728.8	-3726.8	75.28	30.44	56.59	910
* 73.16	29.476	-3662.9	-3660.8	76.19	30.33	56.70	896
* 73.16	0.10182	1466.3	2055.6	154.32	25.74	36.32	169
74	0.10049	1488.2	2085.3	154.73	24.58	34.78	171
76	0.09752	1537.0	2152.3	155.62	22.85	32.46	174
78	0.09479	1582.9	2215.9	156.45	21.95	31.25	177
80	0.09224	1627.2	2277.7	157.23	21.48	30.60	180
82	0.08984	1670.6	2338.5	157.98	21.23	30.23	182

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
84	0.08758	1713.6	2398.7	158.71	21.09	30.02	185
86	0.08543	1756.2	2458.6	159.41	21.01	29.88	187
88	0.08339	1798.8	2518.2	160.10	20.96	29.79	189
90	0.08145	1841.1	2577.8	160.76	20.93	29.73	192
92	0.07961	1883.5	2637.2	161.42	20.91	29.68	194
94	0.07785	1925.7	2696.5	162.06	20.90	29.64	196
96	0.07616	1967.9	2755.7	162.68	20.89	29.61	198
98	0.07455	2010.1	2814.9	163.29	20.89	29.58	200
100	0.07301	2052.2	2874.1	163.89	20.88	29.55	203
102	0.07153	2094.4	2933.1	164.47	20.88	29.53	205
104	0.07011	2136.4	2992.2	165.04	20.87	29.51	207
106	0.06875	2178.5	3051.2	165.61	20.87	29.49	209
108	0.06745	2220.5	3110.1	166.16	20.87	29.47	211
110	0.06619	2262.5	3169.1	166.70	20.86	29.45	213
112	0.06498	2304.5	3228.0	167.23	20.86	29.44	215
114	0.06381	2346.5	3286.8	167.75	20.86	29.42	217
116	0.06268	2388.5	3345.6	168.26	20.85	29.41	219
118	0.06160	2430.4	3404.5	168.76	20.85	29.40	221
120	0.06055	2472.3	3463.2	169.26	20.85	29.38	223
122	0.05954	2514.3	3522.0	169.74	20.85	29.37	224
124	0.05856	2556.2	3580.7	170.22	20.84	29.36	226
126	0.05761	2598.0	3639.4	170.69	20.84	29.35	228
128	0.05670	2639.9	3698.1	171.15	20.84	29.34	230
130	0.05581	2681.8	3756.8	171.61	20.84	29.33	232
132	0.05495	2723.6	3815.4	172.06	20.84	29.32	234
134	0.05412	2765.5	3874.1	172.50	20.83	29.31	235
136	0.05331	2807.3	3932.7	172.93	20.83	29.31	237
138	0.05253	2849.1	3991.3	173.36	20.83	29.30	239
140	0.05177	2890.9	4049.9	173.78	20.83	29.29	241
142	0.05103	2932.7	4108.5	174.20	20.83	29.28	242
144	0.05031	2974.5	4167.0	174.60	20.83	29.28	244
146	0.04962	3016.3	4225.6	175.01	20.82	29.27	246
148	0.04894	3058.1	4284.1	175.41	20.82	29.27	248
150	0.04828	3099.8	4342.7	175.80	20.82	29.26	249
155	0.04670	3204.3	4488.9	176.76	20.82	29.25	253
160	0.04523	3308.6	4635.1	177.69	20.82	29.24	258
165	0.04385	3413.0	4781.3	178.59	20.81	29.23	262
170	0.04255	3517.3	4927.4	179.46	20.81	29.22	266
175	0.04132	3621.5	5073.5	180.31	20.81	29.21	269
180	0.04017	3725.8	5219.5	181.13	20.81	29.20	273
185	0.03908	3830.0	5365.5	181.93	20.81	29.20	277
190	0.03804	3934.3	5511.5	182.71	20.81	29.19	281
195	0.03706	4038.5	5657.4	183.47	20.81	29.19	285
200	0.03613	4142.7	5803.4	184.20	20.81	29.18	288
210	0.03440	4351.0	6095.1	185.63	20.80	29.17	295

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
220	0.03283	4559.3	6386.8	186.98	20.80	29.17	302
230	0.03140	4767.6	6678.5	188.28	20.80	29.16	309
240	0.03009	4975.8	6970.1	189.52	20.80	29.16	316
250	0.02888	5184.0	7261.6	190.71	20.80	29.15	322
260	0.02777	5392.2	7553.1	191.86	20.80	29.15	329
270	0.02674	5600.4	7844.6	192.96	20.81	29.15	335
280	0.02578	5808.7	8136.1	194.02	20.81	29.15	341
290	0.02489	6016.9	8427.6	195.04	20.81	29.15	347
300	0.02406	6225.1	8719.1	196.03	20.81	29.15	353
310	0.02328	6433.4	9010.7	196.98	20.82	29.16	359
320	0.02255	6641.7	9302.3	197.91	20.83	29.16	365
330	0.02187	6850.1	9593.9	198.81	20.83	29.17	370
340	0.02122	7058.6	9885.6	199.68	20.84	29.17	376
350	0.02062	7267.2	10177.	200.52	20.85	29.18	381
360	0.02004	7475.8	10469.	201.35	20.87	29.20	387
370	0.01950	7684.6	10761.	202.15	20.88	29.21	392
380	0.01899	7893.6	11053.	202.92	20.90	29.22	397
390	0.01850	8102.7	11346.	203.68	20.92	29.24	402
400	0.01804	8312.0	11638.	204.42	20.94	29.26	407
420	0.01718	8731.3	12224.	205.85	20.98	29.31	417
440	0.01640	9151.7	12811.	207.22	21.04	29.37	427
460	0.01568	9573.2	13399.	208.52	21.11	29.43	436
480	0.01503	9996.2	13988.	209.78	21.18	29.50	446
500	0.01443	10421.	14579.	210.98	21.27	29.59	454
520	0.01387	10847.	15172.	212.15	21.36	29.68	463
540	0.01336	11275.	15766.	213.27	21.46	29.78	472
560	0.01288	11706.	16363.	214.35	21.57	29.89	480
580	0.01244	12138.	16962.	215.40	21.68	30.00	488
600	0.01202	12573.	17563.	216.42	21.80	30.12	496
620	0.01164	13010.	18166.	217.41	21.92	30.24	504
640	0.01127	13450.	18772.	218.38	22.05	30.36	512
660	0.01093	13892.	19381.	219.31	22.18	30.49	519
680	0.01061	14337.	19992.	220.22	22.31	30.63	527
700	0.01031	14784.	20606.	221.11	22.44	30.76	534
720	0.01002	15235.	21222.	221.98	22.58	30.89	541
740	0.00975	15688.	21842.	222.83	22.71	31.03	548
760	0.00949	16143.	22464.	223.66	22.85	31.17	555
780	0.00925	16602.	23088.	224.47	22.99	31.30	562
800	0.00902	17063.	23716.	225.26	23.12	31.44	568
850	0.00849	18227.	25296.	227.18	23.45	31.77	585
900	0.00802	19408.	26892.	229.01	23.78	32.09	601
950	0.00759	20605.	28505.	230.75	24.09	32.40	616
1000	0.00721	21817.	30133.	232.42	24.38	32.70	631
1050	0.00687	23043.	31775.	234.02	24.66	32.98	646
1100	0.00656	24283.	33430.	235.56	24.93	33.24	660

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1150	0.00627	25535.	35099.	237.04	25.18	33.49	674
1200	0.00601	26800.	36779.	238.48	25.41	33.73	688
1250	0.00577	28076.	38471.	239.86	25.63	33.94	701
1300	0.00555	29363.	40173.	241.19	25.83	34.15	714
1350	0.00534	30659.	41886.	242.48	26.03	34.34	727
1400	0.00515	31965.	43607.	243.74	26.20	34.52	740
1450	0.00498	33280.	45337.	244.95	26.37	34.69	752
1500	0.00481	34602.	47076.	246.13	26.53	34.84	765
1550	0.00466	35932.	48822.	247.27	26.68	34.99	777
1600	0.00451	37270.	50575.	248.39	26.81	35.13	789
1650	0.00437	38614.	52334.	249.47	26.94	35.26	801
1700	0.00424	39964.	54100.	250.52	27.07	35.38	812
1750	0.00412	41320.	55872.	251.55	27.18	35.50	824
1800	0.00401	42682.	57650.	252.55	27.29	35.60	835
1850	0.00390	44049.	59433.	253.53	27.39	35.70	846
1900	0.00380	45421	61220.	254.48	27.49	35.80	857
1950	0.00370	46798	63012.	255.41	27.58	35.89	868
2000	0.00361	48179.	64809.	256.32	27.66	35.98	879
			0.08 MPa Isobar				
* 63.16	31.049	-4228.1	-4225.5	67.88	31.30	56.56	1022
64	30.919	-4180.5	-4177.9	68.63	31.22	56.48	1010
66	30.609	-4067.6	-4065.0	70.37	31.03	56.39	984
68	30.297	-3954.9	-3952.3	72.05	30.84	56.38	958
70	29.983	-3842.1	-3839.4	73.69	30.64	56.45	934
72	29.665	-3729.1	-3726.4	75.28	30.44	56.59	910
74	29.342	-3615.8	-3613.0	76.83	30.24	56.78	887
* 75.40	29.114	-3536.3	-3533.5	77.90	30.10	56.95	871
* 75.40	0.13268	1503.2	2106.1	152.69	26.04	36.99	171
76	0.13143	1519.3	2128.0	152.98	25.15	35.78	172
78	0.12755	1569.4	2196.6	153.88	23.20	33.13	175
80	0.12399	1616.1	2261.3	154.69	22.17	31.73	179
82	0.12068	1661.0	2324.0	155.47	21.63	30.96	181
84	0.11756	1704.9	2385.4	156.21	21.33	30.53	184
86	0.11462	1748.2	2446.2	156.92	21.16	30.26	186
88	0.11184	1791.2	2506.5	157.62	21.07	30.10	189
90	0.10920	1834.0	2566.6	158.29	21.01	29.99	191
92	0.10668	1876.6	2626.5	158.95	20.98	29.91	193
94	0.10429	1919.1	2686.2	159.59	20.95	29.84	196
96	0.10200	1961.6	2745.9	160.22	20.94	29.79	198
98	0.09982	2004.0	2805.4	160.83	20.93	29.75	200
100	0.09773	2046.3	2864.9	161.43	20.92	29.71	202

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
102	0.09573	2088.6	2924.3	162.02	20.91	29.68	204
104	0.09382	2130.9	2983.6	162.60	20.90	29.65	206
106	0.09198	2173.1	3042.9	163.16	20.90	29.62	208
108	0.09021	2215.3	3102.1	163.72	20.89	29.60	210
110	0.08851	2257.5	3161.3	164.26	20.89	29.58	212
112	0.08688	2299.6	3220.4	164.79	20.88	29.55	214
114	0.08531	2341.7	3279.5	165.32	20.88	29.53	216
116	0.08379	2383.8	3338.6	165.83	20.88	29.51	218
118	0.08233	2425.9	3397.6	166.33	20.87	29.50	220
120	0.08092	2467.9	3456.5	166.83	20.87	29.48	222
122	0.07956	2510.0	3515.5	167.32	20.86	29.46	224
124	0.07825	2552.0	3574.4	167.80	20.86	29.45	226
126	0.07697	2594.0	3633.3	168.27	20.86	29.43	228
128	0.07574	2635.9	3692.1	168.73	20.86	29.42	230
130	0.07455	2677.9	3751.0	169.19	20.85	29.41	232
132	0.07340	2719.8	3809.8	169.63	20.85	29.40	233
134	0.07228	2761.8	3868.5	170.08	20.85	29.39	235
136	0.07120	2803.7	3927.3	170.51	20.85	29.37	237
138	0.07015	2845.6	3986.0	170.94	20.84	29.36	239
140	0.06913	2887.5	4044.8	171.36	20.84	29.35	241
142	0.06814	2929.3	4103.5	171.78	20.84	29.35	242
144	0.06717	2971.2	4162.1	172.19	20.84	29.34	244
146	0.06624	3013.1	4220.8	172.59	20.84	29.33	246
148	0.06533	3054.9	4279.5	172.99	20.83	29.32	247
150	0.06445	3096.7	4338.1	173.39	20.83	29.31	249
155	0.06234	3201.3	4484.6	174.35	20.83	29.30	253
160	0.06037	3305.8	4631.1	175.28	20.83	29.28	257
165	0.05851	3410.3	4777.4	176.18	20.82	29.27	261
170	0.05678	3514.7	4923.8	177.05	20.82	29.26	265
175	0.05514	3619.1	5070.0	177.90	20.82	29.25	269
180	0.05359	3723.4	5216.2	178.72	20.82	29.24	273
185	0.05213	3827.8	5362.4	179.52	20.81	29.23	277
190	0.05075	3932.1	5508.5	180.30	20.81	29.22	281
195	0.04944	4036.4	5654.6	181.06	20.81	29.21	284
200	0.04819	4140.6	5800.6	181.80	20.81	29.21	288
210	0.04588	4349.1	6092.6	183.23	20.81	29.20	295
220	0.04379	4557.5	6384.5	184.58	20.81	29.19	302
230	0.04188	4765.9	6676.3	185.88	20.81	29.18	309
240	0.04012	4974.2	6968.1	187.12	20.81	29.17	316
250	0.03851	5182.5	7259.8	188.31	20.81	29.17	322
260	0.03703	5390.8	7551.5	189.46	20.81	29.16	329
270	0.03565	5599.1	7843.1	190.56	20.81	29.16	335
280	0.03437	5807.4	8134.7	191.62	20.81	29.16	341
290	0.03319	6015.7	8426.3	192.64	20.81	29.16	347
300	0.03208	6224.0	8717.9	193.63	20.82	29.16	353

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
310	0.03104	6432.3	9009.5	194.59	20.82	29.16	359
320	0.03007	6640.7	9301.2	195.51	20.83	29.17	365
330	0.02916	6849.1	9592.9	196.41	20.83	29.17	370
340	0.02830	7057.6	9884.7	197.28	20.84	29.18	376
350	0.02749	7266.2	10177.	198.13	20.85	29.19	381
360	0.02672	7474.9	10468.	198.95	20.87	29.20	387
370	0.02600	7683.8	10761.	199.75	20.88	29.21	392
380	0.02532	7892.8	11053.	200.53	20.90	29.23	397
390	0.02467	8101.9	11345.	201.29	20.92	29.25	402
400	0.02405	8311.3	11638.	202.03	20.94	29.27	407
420	0.02290	8730.6	12224.	203.46	20.98	29.31	417
440	0.02186	9151.0	12810.	204.82	21.04	29.37	427
460	0.02091	9572.6	13398.	206.13	21.11	29.43	436
480	0.02004	9995.6	13988.	207.39	21.18	29.51	446
500	0.01924	10420.	14579.	208.59	21.27	29.59	455
520	0.01850	10847.	15171.	209.75	21.36	29.68	463
540	0.01781	11275.	15766.	210.88	21.46	29.78	472
560	0.01718	11705.	16363.	211.96	21.57	29.89	480
580	0.01658	12138.	16962.	213.01	21.68	30.00	488
600	0.01603	12572.	17563.	214.03	21.80	30.12	496
620	0.01551	13010.	18166.	215.02	21.92	30.24	504
640	0.01503	13449.	18772.	215.98	22.05	30.37	512
660	0.01457	13892.	19381.	216.92	22.18	30.49	519
680	0.01415	14336.	19992.	217.83	22.31	30.63	527
700	0.01374	14784.	20606.	218.72	22.44	30.76	534
720	0.01336	15234.	21223.	219.59	22.58	30.90	541
740	0.01300	15687.	21842.	220.44	22.71	31.03	548
760	0.01266	16143.	22464.	221.27	22.85	31.17	555
780	0.01233	16601.	23088.	222.08	22.99	31.30	562
800	0.01202	17062.	23716.	222.87	23.12	31.44	568
850	0.01132	18227.	25296.	224.79	23.45	31.77	585
900	0.01069	19408.	26893.	226.61	23.78	32.09	601
950	0.01013	20604.	28505.	228.36	24.09	32.40	616
1000	0.00962	21816.	30133.	230.03	24.38	32.70	631
1050	0.00916	23043.	31775.	231.63	24.66	32.98	646
1100	0.00874	24283.	33431.	233.17	24.93	33.24	660
1150	0.00836	25535.	35099.	234.65	25.18	33.49	674
1200	0.00802	26800.	36780.	236.08	25.41	33.73	688
1250	0.00770	28076.	38471.	237.46	25.63	33.94	701
1300	0.00740	29363.	40174.	238.80	25.83	34.15	714
1350	0.00713	30659.	41886.	240.09	26.03	34.34	727
1400	0.00687	31965.	43608.	241.34	26.20	34.52	740
1450	0.00663	33280.	45338.	242.56	26.37	34.69	753
1500	0.00641	34602.	47076.	243.74	26.53	34.84	765
1550	0.00621	35932.	48822.	244.88	26.68	34.99	777

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1600	0.00601	37270.	50575.	246.00	26.81	35.13	789
1650	0.00583	38614.	52335.	247.08	26.94	35.26	801
1700	0.00566	39964.	54101.	248.13	27.07	35.38	812
1750	0.00550	41320.	55873.	249.16	27.18	35.50	824
1800	0.00534	42682.	57650.	250.16	27.29	35.60	835
1850	0.00520	44049.	59433.	251.14	27.39	35.70	846
1900	0.00506	45421.	61221.	252.09	27.49	35.80	857
1950	0.00493	46798.	63013.	253.02	27.58	35.89	868
2000	0.00481	48179.	64810.	253.93	27.66	35.98	879
			0.10 MPa Isobar				
* 63.16	31.050	-4228.1	-4224.8	67.88	31.30	56.55	1022
64	30.920	-4180.7	-4177.4	68.63	31.22	56.48	1010
66	30.611	-4067.8	-4064.6	70.37	31.03	56.39	984
68	30.299	-3955.1	-3951.8	72.05	30.84	56.38	958
70	29.984	-3842.3	-3839.0	73.68	30.64	56.45	934
72	29.666	-3729.4	-3726.0	75.28	30.44	56.58	910
74	29.344	-3616.0	-3612.6	76.83	30.24	56.78	887
76	29.017	-3502.3	-3498.8	78.35	30.04	57.02	865
* 77.24	28.813	-3431.7	-3428.2	79.27	29.91	57.20	851
* 77.24	0.16298	1532.4	2146.0	151.44	26.26	37.53	172
78	0.16105	1553.1	2174.0	151.80	25.13	35.99	174
80	0.15634	1603.5	2243.1	152.67	23.23	33.38	177
82	0.15201	1650.5	2308.3	153.48	22.23	31.98	180
84	0.14798	1695.7	2371.4	154.24	21.68	31.19	183
86	0.14420	1739.8	2433.3	154.97	21.38	30.74	186
88	0.14063	1783.4	2494.5	155.67	21.21	30.46	188
90	0.13725	1826.6	2555.2	156.35	21.11	30.28	191
92	0.13405	1869.6	2615.6	157.02	21.05	30.15	193
94	0.13099	1912.5	2675.9	157.67	21.01	30.06	195
96	0.12809	1955.2	2735.9	158.30	20.98	29.99	197
98	0.12531	1997.8	2795.8	158.92	20.97	29.93	200
100	0.12266	2040.4	2855.6	159.52	20.95	29.88	202
102	0.12012	2082.9	2915.4	160.11	20.94	29.84	204
104	0.11769	2125.3	2975.0	160.69	20.93	29.80	206
106	0.11536	2167.7	3034.6	161.26	20.93	29.76	208
108	0.11313	2210.1	3094.0	161.81	20.92	29.73	210
110	0.11098	2252.4	3153.5	162.36	20.91	29.70	212
112	0.10891	2294.7	3212.8	162.89	20.91	29.67	214
114	0.10693	2336.9	3272.2	163.42	20.90	29.65	216
116	0.10501	2379.2	3331.4	163.93	20.90	29.62	218
118	0.10317	2421.4	3390.6	164.44	20.89	29.60	220

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
120	0.10139	2463.5	3449.8	164.94	20.89	29.58	222
122	0.09967	2505.7	3509.0	165.43	20.88	29.56	224
124	0.09801	2547.8	3568.0	165.91	20.88	29.54	226
126	0.09641	2589.9	3627.1	166.38	20.88	29.52	228
128	0.09486	2631.9	3686.1	166.84	20.87	29.50	230
130	0.09336	2674.0	3745.1	167.30	20.87	29.49	231
132	0.09191	2716.0	3804.1	167.75	20.87	29.47	233
134	0.09050	2758.0	3863.0	168.19	20.86	29.46	235
136	0.08914	2800.0	3921.9	168.63	20.86	29.44	237
138	0.08782	2842.0	3980.8	169.06	20.86	29.43	239
140	0.08653	2884.0	4039.6	169.48	20.85	29.42	240
142	0.08529	2925.9	4098.4	169.90	20.85	29.41	242
144	0.08408	2967.9	4157.2	170.31	20.85	29.40	244
146	0.08290	3009.8	4216.0	170.72	20.85	29.39	246
148	0.08176	3051.7	4274.8	171.12	20.84	29.38	247
150	0.08065	3093.6	4333.5	171.51	20.84	29.37	249
155	0.07800	3198.3	4480.3	172.47	20.84	29.35	253
160	0.07553	3303.0	4627.0	173.40	20.83	29.33	257
165	0.07321	3407.6	4773.6	174.31	20.83	29.31	261
170	0.07102	3512.1	4920.1	175.18	20.83	29.29	265
175	0.06897	3616.6	5066.5	176.03	20.82	29.28	269
180	0.06703	3721.1	5212.9	176.86	20.82	29.27	273
185	0.06520	3825.5	5359.2	177.66	20.82	29.26	277
190	0.06347	3929.9	5505.5	178.44	20.82	29.25	281
195	0.06183	4034.3	5651.7	179.20	20.82	29.24	284
200	0.06027	4138.6	5797.9	179.94	20.81	29.23	288
210	0.05738	4347.2	6090.1	181.36	20.81	29.22	295
220	0.05475	4555.8	6382.2	182.72	20.81	29.21	302
230	0.05236	4764.2	6674.2	184.02	20.81	29.20	309
240	0.05016	4972.7	6966.1	185.26	20.81	29.19	316
250	0.04815	5181.1	7258.0	186.45	20.81	29.18	322
260	0.04629	5389.4	7549.8	187.60	20.81	29.18	329
270	0.04457	5597.8	7841.5	188.70	20.81	29.17	335
280	0.04297	5806.1	8133.2	189.76	20.81	29.17	341
290	0.04149	6014.5	8425.0	190.78	20.81	29.17	347
300	0.04010	6222.8	8716.7	191.77	20.82	29.17	353
310	0.03880	6431.2	9008.4	192.73	20.82	29.17	359
320	0.03759	6639.6	9300.1	193.66	20.83	29.18	365
330	0.03645	6848.1	9591.9	194.55	20.84	29.18	370
340	0.03537	7056.7	9883.7	195.42	20.84	29.19	376
350	0.03436	7265.3	10176.	196.27	20.86	29.20	381
360	0.03340	7474.0	10468.	197.09	20.87	29.21	387
370	0.03250	7682.9	10760.	197.89	20.88	29.22	392
380	0.03164	7891.9	11052.	198.67	20.90	29.23	397
390	0.03083	8101.1	11345.	199.43	20.92	29.25	402

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
400	0.03006	8310.5	11637.	200.17	20.94	29.27	408
420	0.02863	8729.9	12223.	201.60	20.99	29.32	417
440	0.02733	9150.3	12810.	202.97	21.04	29.37	427
460	0.02614	9572.0	13398.	204.27	21.11	29.44	436
480	0.02505	9995.0	13987.	205.53	21.18	29.51	446
500	0.02405	10420.	14578.	206.74	21.27	29.59	455
520	0.02312	10846.	15171.	207.90	21.36	29.68	463
540	0.02226	11274.	15766.	209.02	21.46	29.78	472
560	0.02147	11705.	16363.	210.11	21.57	29.89	480
580	0.02073	12137.	16962.	211.16	21.68	30.00	488
600	0.02004	12572.	17563.	212.17	21.80	30.12	496
620	0.01939	13009.	18166.	213.16	21.92	30.24	504
640	0.01878	13449.	18772.	214.13	22.05	30.37	512
660	0.01822	13891.	19381.	215.06	22.18	30.50	519
680	0.01768	14336.	19992.	215.98	22.31	30.63	527
700	0.01717	14784.	20606.	216.87	22.44	30.76	534
720	0.01670	15234.	21223.	217.73	22.58	30.90	541
740	0.01625	15687.	21842.	218.58	22.71	31.03	548
760	0.01582	16143.	22464.	219.41	22.85	31.17	555
780	0.01541	16601.	23089.	220.22	22.99	31.30	562
800	0.01503	17062.	23716.	221.02	23.12	31.44	568
850	0.01414	18227.	25296.	222.93	23.45	31.77	585
900	0.01336	19407.	26893.	224.76	23.78	32.09	601
950	0.01266	20604.	28506.	226.50	24.09	32.40	616
1000	0.01202	21816.	30133.	228.17	24.38	32.70	631
1050	0.01145	23043.	31775.	229.77	24.66	32.98	646
1100	0.01093	24282.	33431.	231.31	24.93	33.24	660
1150	0.01046	25535.	35100.	232.80	25.18	33.49	674
1200	0.01002	26800.	36780.	234.23	25.41	33.73	688
1250	0.00962	28076.	38472.	235.61	25.63	33.94	701
1300	0.00925	29363.	40174.	236.94	25.83	34.15	714
1350	0.00891	30659.	41887.	238.24	26.03	34.34	727
1400	0.00859	31965.	43608.	239.49	26.20	34.52	740
1450	0.00829	33280.	45338.	240.70	26.37	34.69	753
1500	0.00802	34602.	47077.	241.88	26.53	34.84	765
1550	0.00776	35932.	48823.	243.03	26.68	34.99	777
1600	0.00752	37270.	50576.	244.14	26.82	35.13	789
1650	0.00729	38614.	52336.	245.22	26.94	35.26	801
1700	0.00707	39964.	54102.	246.28	27.07	35.38	812
1750	0.00687	41320.	55874.	247.30	27.18	35.50	824
1800	0.00668	42682.	57651.	248.31	27.29	35.60	835
1850	0.00650	44049.	59434.	249.28	27.39	35.70	846
1900	0.00633	45421.	61221.	250.24	27.49	35.80	857
1950	0.00617	46798.	63014.	251.17	27.58	35.89	868
2000	0.00601	48179.	64810.	252.08	27.66	35.98	879

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
			0.101325 MPa Isobar				
* 63.16	31.050	-4228.1	-4224.8	67.88	31.30	56.55	1022
64	30.920	-4180.7	-4177.4	68.63	31.22	56.48	1010
66	30.611	-4067.9	-4064.6	70.37	31.03	56.39	984
68	30.299	-3955.1	-3951.8	72.05	30.84	56.38	958
70	29.984	-3842.4	-3839.0	73.68	30.64	56.45	934
72	29.666	-3729.4	-3726.0	75.28	30.44	56.58	910
74	29.344	-3616.1	-3612.6	76.83	30.24	56.78	887
76	29.018	-3502.3	-3498.8	78.35	30.04	57.02	865
* 77.35	28.794	-3425.4	-3421.8	79.35	29.90	57.21	850
* 77.35	0.16497	1534.1	2148.3	151.36	26.27	37.56	172
78	0.16330	1551.9	2172.4	151.67	25.29	36.22	174
80	0.15850	1602.6	2241.8	152.55	23.32	33.51	177
82	0.15411	1649.7	2307.2	153.36	22.28	32.06	180
84	0.15002	1695.0	2370.5	154.12	21.71	31.25	183
86	0.14618	1739.3	2432.4	154.85	21.40	30.77	186
88	0.14255	1782.9	2493.7	155.56	21.22	30.49	188
90	0.13912	1826.1	2554.4	156.24	21.12	30.30	190
92	0.13587	1869.2	2614.9	156.90	21.05	30.17	193
94	0.13277	1912.0	2675.2	157.55	21.01	30.08	195
96	0.12982	1954.7	2735.2	158.18	20.99	30.00	197
98	0.12701	1997.4	2795.2	158.80	20.97	29.94	200
100	0.12432	2040.0	2855.0	159.41	20.96	29.89	202
102	0.12174	2082.5	2914.8	160.00	20.95	29.85	204
104	0.11928	2124.9	2974.4	160.58	20.94	29.81	206
106	0.11692	2167.4	3034.0	161.14	20.93	29.77	208
108	0.11465	2209.7	3093.5	161.70	20.92	29.74	210
110	0.11247	2252.1	3153.0	162.25	20.91	29.71	212
112	0.11038	2294.4	3212.3	162.78	20.91	29.68	214
114	0.10836	2336.6	3271.7	163.31	20.90	29.65	216
116	0.10642	2378.8	3331.0	163.82	20.90	29.63	218
118	0.10455	2421.1	3390.2	164.33	20.89	29.60	220
120	0.10275	2463.2	3449.4	164.82	20.89	29.58	222
122	0.10101	2505.4	3508.5	165.31	20.88	29.56	224
124	0.09933	2547.5	3567.6	165.79	20.88	29.54	226
126	0.09770	2589.6	3626.7	166.27	20.88	29.52	228
128	0.09613	2631.7	3685.7	166.73	20.87	29.51	230
130	0.09461	2673.7	3744.7	167.19	20.87	29.49	231
132	0.09314	2715.8	3803.7	167.64	20.87	29.48	233
134	0.09171	2757.8	3862.6	168.08	20.86	29.46	235
136	0.09033	2799.8	3921.5	168.52	20.86	29.45	237

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
138	0.08899	2841.8	3980.4	168.95	20.86	29.43	239
140	0.08769	2883.8	4039.3	169.37	20.85	29.42	240
142	0.08643	2925.7	4098.1	169.79	20.85	29.41	242
144	0.08520	2967.7	4156.9	170.20	20.85	29.40	244
146	0.08401	3009.6	4215.7	170.61	20.85	29.39	246
148	0.08285	3051.5	4274.5	171.01	20.85	29.38	247
150	0.08173	3093.4	4333.2	171.40	20.84	29.37	249
155	0.07904	3198.1	4480.0	172.36	20.84	29.35	253
160	0.07653	3302.8	4626.7	173.29	20.83	29.33	257
165	0.07418	3407.4	4773.3	174.20	20.83	29.31	261
170	0.07197	3511.9	4919.8	175.07	20.83	29.30	265
175	0.06989	3616.4	5066.3	175.92	20.83	29.28	269
180	0.06792	3720.9	5212.7	176.74	20.82	29.27	273
185	0.06607	3825.3	5359.0	177.55	20.82	29.26	277
190	0.06431	3929.7	5505.3	178.33	20.82	29.25	281
195	0.06265	4034.1	5651.5	179.09	20.82	29.24	284
200	0.06107	4138.5	5797.7	179.83	20.82	29.23	288
210	0.05814	4347.1	6089.9	181.25	20.81	29.22	295
220	0.05548	4555.6	6382.1	182.61	20.81	29.21	302
230	0.05305	4764.1	6674.1	183.91	20.81	29.20	309
240	0.05083	4972.6	6966.0	185.15	20.81	29.19	316
250	0.04879	5181.0	7257.9	186.34	20.81	29.18	322
260	0.04690	5389.3	7549.7	187.49	20.81	29.18	329
270	0.04516	5597.7	7841.4	188.59	20.81	29.17	335
280	0.04354	5806.0	8133.2	189.65	20.81	29.17	341
290	0.04204	6014.4	8424.9	190.67	20.81	29.17	347
300	0.04063	6222.7	8716.6	191.66	20.82	29.17	353
310	0.03932	6431.1	9008.3	192.62	20.82	29.17	359
320	0.03809	6639.6	9300.0	193.55	20.83	29.18	365
330	0.03693	6848.0	9591.8	194.44	20.84	29.18	370
340	0.03584	7056.6	9883.7	195.31	20.84	29.19	376
350	0.03482	7265.2	10176.	196.16	20.86	29.20	381
360	0.03385	7474.0	10468.	196.98	20.87	29.21	387
370	0.03293	7682.9	10760.	197.78	20.88	29.22	392
380	0.03206	7891.9	11052.	198.56	20.90	29.24	397
390	0.03124	8101.1	11344.	199.32	20.92	29.25	402
400	0.03046	8310.4	11637.	200.06	20.94	29.27	408
420	0.02901	8729.8	12223.	201.49	20.99	29.32	417
440	0.02769	9150.3	12810.	202.86	21.04	29.37	427
460	0.02648	9571.9	13398.	204.17	21.11	29.44	437
480	0.02538	9995.0	13987.	205.42	21.18	29.51	446
500	0.02436	10420.	14578.	206.63	21.27	29.59	455
520	0.02343	10846.	15171.	207.79	21.36	29.69	463
540	0.02256	11274.	15766.	208.91	21.46	29.78	472
560	0.02175	11705.	16363.	210.00	21.57	29.89	480

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
580	0.02100	12137.	16962.	211.05	21.68	30.00	488
600	0.02030	12572.	17563.	212.07	21.80	30.12	496
620	0.01965	13009.	18166.	213.06	21.92	30.24	504
640	0.01903	13449.	18772.	214.02	22.05	30.37	512
660	0.01846	13891.	19381.	214.95	22.18	30.50	519
680	0.01791	14336.	19992.	215.87	22.31	30.63	527
700	0.01740	14784.	20606.	216.76	22.44	30.76	534
720	0.01692	15234.	21223.	217.62	22.58	30.90	541
740	0.01646	15687.	21842.	218.47	22.71	31.03	548
760	0.01603	16143.	22464.	219.30	22.85	31.17	555
780	0.01562	16601.	23089.	220.11	22.99	31.30	562
800	0.01523	17062.	23716.	220.91	23.12	31.44	568
850	0.01433	18227.	25296.	222.82	23.45	31.77	585
900	0.01354	19407.	26893.	224.65	23.78	32.09	601
950	0.01282	20604.	28506.	226.39	24.09	32.40	616
1000	0.01218	21816.	30133.	228.06	24.38	32.70	631
1050	0.01160	23043.	31775.	229.66	24.66	32.98	646
1100	0.01108	24282.	33431.	231.20	24.93	33.24	660
1150	0.01059	25535.	35100.	232.69	25.18	33.49	674
1200	0.01015	26800.	36780.	234.12	25.41	33.73	688
1250	0.00975	28076.	38472.	235.50	25.63	33.94	701
1300	0.00937	29363.	40174.	236.84	25.83	34.15	714
1350	0.00902	30659.	41887.	238.13	26.03	34.34	727
1400	0.00870	31965.	43608.	239.38	26.20	34.52	740
1450	0.00840	33280.	45338.	240.59	26.37	34.69	753
1500	0.00812	34602.	47077.	241.77	26.53	34.84	765
1550	0.00786	35932.	48823.	242.92	26.68	34.99	777
1600	0.00761	37270.	50576.	244.03	26.82	35.13	789
1650	0.00738	38614.	52336.	245.11	26.94	35.26	801
1700	0.00717	39964.	54102.	246.17	27.07	35.38	812
1750	0.00696	41320.	55874.	247.20	27.18	35.50	824
1800	0.00677	42682.	57651.	248.20	27.29	35.60	835
1850	0.00659	44049.	59434.	249.17	27.39	35.70	846
1900	0.00641	45421.	61221.	250.13	27.49	35.80	857
1950	0.00625	46798.	63014.	251.06	27.58	35.89	868
2000	0.00609	48179.	64810.	251.97	27.66	35.98	879
			0.15 MPa Isobar				
* 63.17	31.051	-4228.1	-4223.2	67.88	31.30	56.55	1022
64	30.923	-4181.2	-4176.3	68.62	31.22	56.48	1011
66	30.614	-4068.4	-4063.5	70.36	31.03	56.38	984
68	30.302	-3955.7	-3950.8	72.04	30.84	56.37	959

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
70	29.988	-3843.0	-3838.0	73.68	30.65	56.44	934
72	29.670	-3730.0	-3725.0	75.27	30.45	56.57	911
74	29.348	-3616.7	-3611.6	76.82	30.24	56.76	888
76	29.022	-3503.0	-3497.9	78.34	30.04	57.01	865
78	28.690	-3388.8	-3383.6	79.82	29.83	57.30	843
80	28.353	-3273.9	-3268.6	81.28	29.63	57.65	821
* 80.84	28.210	-3225.7	-3220.3	81.88	29.54	57.81	812
* 80.84	0.23713	1586.5	2219.0	149.17	26.59	38.58	175
82	0.23289	1618.4	2262.5	149.70	24.96	36.28	177
84	0.22617	1669.2	2332.4	150.54	23.24	33.83	180
86	0.22000	1716.7	2398.6	151.32	22.30	32.48	183
88	0.21425	1762.5	2462.7	152.06	21.78	31.69	186
90	0.20885	1807.3	2525.5	152.76	21.48	31.21	189
92	0.20376	1851.5	2587.6	153.45	21.31	30.90	191
94	0.19895	1895.2	2649.2	154.11	21.20	30.69	194
96	0.19437	1938.7	2710.4	154.75	21.13	30.54	196
98	0.19002	1982.0	2771.4	155.38	21.09	30.42	198
100	0.18588	2025.2	2832.1	155.99	21.06	30.33	201
102	0.18193	2068.2	2892.7	156.59	21.04	30.25	203
104	0.17815	2111.1	2953.1	157.18	21.02	30.18	205
106	0.17453	2154.0	3013.4	157.76	21.00	30.12	207
108	0.17107	2196.8	3073.6	158.32	20.99	30.07	209
110	0.16775	2239.5	3133.7	158.87	20.98	30.02	211
112	0.16456	2282.2	3193.7	159.41	20.97	29.98	213
114	0.16149	2324.8	3253.6	159.94	20.96	29.93	215
116	0.15855	2367.4	3313.5	160.46	20.95	29.89	217
118	0.15571	2409.9	3373.2	160.97	20.95	29.86	219
120	0.15298	2452.4	3432.9	161.47	20.94	29.82	221
122	0.15035	2494.8	3492.5	161.96	20.93	29.79	223
124	0.14780	2537.2	3552.1	162.45	20.93	29.76	225
126	0.14535	2579.6	3611.6	162.93	20.92	29.74	227
128	0.14298	2621.9	3671.0	163.39	20.91	29.71	229
130	0.14069	2664.2	3730.4	163.85	20.91	29.68	231
132	0.13847	2706.5	3789.8	164.31	20.90	29.66	233
134	0.13632	2748.7	3849.0	164.75	20.90	29.64	235
136	0.13424	2790.9	3908.3	165.19	20.89	29.62	236
138	0.13223	2833.1	3967.5	165.62	20.89	29.60	238
140	0.13027	2875.3	4026.7	166.05	20.89	29.58	240
142	0.12838	2917.4	4085.8	166.47	20.88	29.56	242
144	0.12654	2959.6	4144.9	166.88	20.88	29.55	243
146	0.12475	3001.7	4204.0	167.29	20.88	29.53	245
148	0.12302	3043.7	4263.1	167.69	20.87	29.51	247
150	0.12133	3085.8	4322.1	168.09	20.87	29.50	249
155	0.11732	3190.9	4469.5	169.05	20.86	29.47	253
160	0.11356	3295.9	4616.8	169.99	20.86	29.44	257

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
165	0.11005	3400.8	4763.9	170.89	20.85	29.41	261
170	0.10674	3505.6	4910.9	171.77	20.85	29.39	265
175	0.10364	3610.4	5057.8	172.62	20.84	29.37	269
180	0.10071	3715.1	5204.6	173.45	20.84	29.35	273
185	0.09794	3819.8	5351.3	174.26	20.83	29.33	277
190	0.09533	3924.4	5497.9	175.04	20.83	29.32	281
195	0.09285	4029.0	5644.5	175.80	20.83	29.31	284
200	0.09050	4133.5	5791.0	176.54	20.83	29.29	288
210	0.08614	4342.5	6083.8	177.97	20.82	29.27	295
220	0.08219	4551.3	6376.4	179.33	20.82	29.25	302
230	0.07858	4760.1	6668.9	180.63	20.82	29.24	309
240	0.07528	4968.7	6961.2	181.87	20.81	29.23	316
250	0.07225	5177.4	7253.5	183.07	20.81	29.22	322
260	0.06946	5385.9	7545.6	184.21	20.81	29.21	329
270	0.06687	5594.4	7837.6	185.32	20.81	29.20	335
280	0.06447	5803.0	8129.6	186.38	20.82	29.20	341
290	0.06224	6011.4	8421.6	187.40	20.82	29.19	347
300	0.06015	6219.9	8713.5	188.39	20.82	29.19	353
310	0.05821	6428.5	9005.5	189.35	20.83	29.19	359
320	0.05638	6637.0	9297.4	190.28	20.83	29.20	365
330	0.05467	6845.6	9589.4	191.17	20.84	29.20	370
340	0.05306	7054.2	9881.4	192.05	20.85	29.20	376
350	0.05154	7263.0	10173.	192.89	20.86	29.21	381
360	0.05010	7471.8	10466.	193.72	20.87	29.22	387
370	0.04875	7680.8	10758.	194.52	20.88	29.23	392
380	0.04746	7889.8	11050.	195.30	20.90	29.25	397
390	0.04624	8099.1	11343.	196.06	20.92	29.26	403
400	0.04508	8308.5	11636.	196.80	20.94	29.28	408
420	0.04294	8728.1	12222.	198.23	20.99	29.33	418
440	0.04098	9148.6	12809.	199.59	21.04	29.38	427
460	0.03920	9570.4	13397.	200.90	21.11	29.45	437
480	0.03756	9993.5	13987.	202.15	21.19	29.52	446
500	0.03606	10418.	14578.	203.36	21.27	29.60	455
520	0.03467	10845.	15171.	204.52	21.36	29.69	463
540	0.03339	11273.	15766.	205.65	21.46	29.79	472
560	0.03220	11703.	16362.	206.73	21.57	29.89	480
580	0.03109	12136.	16961.	207.78	21.68	30.01	488
600	0.03005	12571.	17563.	208.80	21.80	30.12	496
620	0.02908	13008.	18166.	209.79	21.92	30.25	504
640	0.02817	13448.	18773.	210.75	22.05	30.37	512
660	0.02732	13890.	19381.	211.69	22.18	30.50	519
680	0.02651	14335.	19993.	212.60	22.31	30.63	527
700	0.02576	14783.	20606.	213.49	22.44	30.76	534
720	0.02504	15233.	21223.	214.36	22.58	30.90	541
740	0.02437	15686.	21842.	215.21	22.71	31.03	548

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
760	0.02372	16142.	22465.	216.04	22.85	31.17	555
780	0.02312	16600.	23089.	216.85	22.99	31.31	562
800	0.02254	17061.	23717.	217.64	23.12	31.44	569
850	0.02121	18226.	25297.	219.56	23.46	31.77	585
900	0.02003	19407.	26894.	221.39	23.78	32.10	601
950	0.01898	20604.	28507.	223.13	24.09	32.41	616
1000	0.01803	21816.	30134.	224.80	24.38	32.70	631
1050	0.01717	23042.	31776.	226.40	24.66	32.98	646
1100	0.01639	24282.	33432.	227.94	24.93	33.25	660
1150	0.01568	25535.	35101.	229.43	25.18	33.49	674
1200	0.01503	26800.	36781.	230.86	25.41	33.73	688
1250	0.01443	28076.	38473.	232.24	25.63	33.95	701
1300	0.01387	29362.	40176.	233.57	25.83	34.15	714
1350	0.01336	30659.	41888.	234.87	26.03	34.34	727
1400	0.01288	31965.	43610.	236.12	26.21	34.52	740
1450	0.01244	33279.	45340.	237.33	26.37	34.69	753
1500	0.01202	34602.	47078.	238.51	26.53	34.84	765
1550	0.01164	35932.	48824.	239.66	26.68	34.99	777
1600	0.01127	37270.	50577.	240.77	26.82	35.13	789
1650	0.01093	38614.	52337.	241.85	26.94	35.26	801
1700	0.01061	39964.	54103.	242.91	27.07	35.38	812
1750	0.01031	41320.	55875.	243.93	27.18	35.50	824
1800	0.01002	42682.	57653.	244.94	27.29	35.60	835
1850	0.00975	44049.	59435.	245.91	27.39	35.70	846
1900	0.00949	45421.	61223.	246.87	27.49	35.80	857
1950	0.00925	46798.	63015.	247.80	27.58	35.89	868
2000	0.00902	48179.	64812.	248.71	27.66	35.98	879
			0.20 MPa Isobar				
* 63.18	31.053	-4228.0	-4221.6	67.89	31.30	56.54	1023
64	30.927	-4181.7	-4175.2	68.61	31.23	56.47	1011
66	30.617	-4068.9	-4062.4	70.35	31.04	56.37	985
68	30.306	-3956.3	-3949.7	72.03	30.85	56.36	959
70	29.992	-3843.6	-3836.9	73.67	30.65	56.43	935
72	29.674	-3730.7	-3723.9	75.26	30.45	56.56	911
74	29.353	-3617.4	-3610.6	76.81	30.25	56.75	888
76	29.026	-3503.8	-3496.9	78.33	30.04	56.99	866
78	28.695	-3389.6	-3382.6	79.81	29.84	57.29	843
80	28.358	-3274.8	-3267.7	81.27	29.63	57.63	821
82	28.014	-3159.2	-3152.1	82.69	29.42	58.03	800
* 83.62	27.731	-3065.1	-3057.9	83.83	29.26	58.39	782
* 83.62	0.30985	1625.0	2270.5	147.55	26.76	39.41	176

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
84	0.30798	1636.0	2285.4	147.73	26.17	38.54	177
86	0.29881	1689.6	2358.9	148.60	23.97	35.35	181
88	0.29046	1739.1	2427.7	149.39	22.77	33.56	184
90	0.28273	1786.3	2493.7	150.13	22.10	32.52	187
92	0.27551	1832.1	2558.0	150.84	21.71	31.89	190
94	0.26872	1877.1	2621.4	151.52	21.48	31.47	192
96	0.26231	1921.6	2684.0	152.18	21.34	31.19	195
98	0.25624	1965.7	2746.2	152.82	21.25	30.99	197
100	0.25047	2009.5	2808.0	153.44	21.19	30.83	199
102	0.24498	2053.1	2869.5	154.05	21.14	30.71	202
104	0.23975	2096.6	2930.8	154.65	21.11	30.60	204
106	0.23476	2140.0	2991.9	155.23	21.09	30.51	206
108	0.22999	2183.3	3052.9	155.80	21.07	30.43	208
110	0.22542	2226.4	3113.7	156.36	21.05	30.36	210
112	0.22104	2269.5	3174.3	156.90	21.04	30.29	213
114	0.21684	2312.5	3234.9	157.44	21.02	30.24	215
116	0.21280	2355.4	3295.3	157.96	21.01	30.18	217
118	0.20892	2398.3	3355.6	158.48	21.00	30.13	219
120	0.20519	2441.1	3415.8	158.99	20.99	30.08	221
122	0.20160	2483.8	3475.9	159.48	20.98	30.04	223
124	0.19814	2526.5	3535.9	159.97	20.97	30.00	225
126	0.19479	2569.2	3595.9	160.45	20.96	29.96	227
128	0.19157	2611.8	3655.8	160.92	20.96	29.92	228
130	0.18845	2654.3	3715.6	161.39	20.95	29.89	230
132	0.18544	2696.8	3775.3	161.84	20.94	29.85	232
134	0.18253	2739.3	3835.0	162.29	20.94	29.82	234
136	0.17971	2781.8	3894.6	162.73	20.93	29.80	236
138	0.17698	2824.2	3954.2	163.17	20.92	29.77	238
140	0.17434	2866.5	4013.7	163.59	20.92	29.74	240
142	0.17178	2908.9	4073.2	164.02	20.91	29.72	241
144	0.16929	2951.2	4132.6	164.43	20.91	29.70	243
146	0.16688	2993.5	4192.0	164.84	20.90	29.68	245
148	0.16453	3035.7	4251.3	165.25	20.90	29.65	247
150	0.16225	3078.0	4310.6	165.64	20.90	29.64	248
155	0.15684	3183.4	4458.6	166.61	20.89	29.59	253
160	0.15178	3288.8	4606.5	167.55	20.88	29.55	257
165	0.14704	3394.0	4754.2	168.46	20.87	29.52	261
170	0.14260	3499.2	4901.7	169.34	20.86	29.49	265
175	0.13843	3604.2	5049.0	170.20	20.86	29.46	269
180	0.13449	3709.2	5196.3	171.03	20.85	29.43	273
185	0.13078	3814.1	5343.4	171.83	20.85	29.41	277
190	0.12727	3918.9	5490.4	172.62	20.84	29.39	281
195	0.12395	4023.7	5637.3	173.38	20.84	29.37	284
200	0.12080	4128.4	5784.1	174.12	20.84	29.36	288
210	0.11496	4337.7	6077.5	175.55	20.83	29.33	295

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
220	0.10966	4546.9	6370.7	176.92	20.83	29.30	302
230	0.10484	4755.9	6663.6	178.22	20.82	29.28	309
240	0.10043	4964.8	6956.3	179.47	20.82	29.27	316
250	0.09637	5173.7	7248.9	180.66	20.82	29.25	322
260	0.09264	5382.4	7541.4	181.81	20.82	29.24	329
270	0.08918	5591.1	7833.8	182.91	20.82	29.23	335
280	0.08597	5799.8	8126.0	183.97	20.82	29.22	341
290	0.08299	6008.4	8418.3	185.00	20.82	29.22	347
300	0.08021	6217.1	8710.4	185.99	20.82	29.22	353
310	0.07761	6425.7	9002.6	186.95	20.83	29.21	359
320	0.07518	6634.4	9294.7	187.88	20.83	29.21	365
330	0.07289	6843.1	9586.9	188.77	20.84	29.22	371
340	0.07074	7051.8	9879.1	189.65	20.85	29.22	376
350	0.06871	7260.6	10171.	190.49	20.86	29.23	382
360	0.06680	7469.6	10464.	191.32	20.87	29.24	387
370	0.06499	7678.6	10756.	192.12	20.89	29.25	392
380	0.06327	7887.8	11049.	192.90	20.90	29.26	398
390	0.06165	8097.1	11341.	193.66	20.92	29.28	403
400	0.06010	8306.6	11634.	194.40	20.94	29.29	408
420	0.05724	8726.3	12220.	195.83	20.99	29.34	418
440	0.05463	9146.9	12808.	197.20	21.05	29.39	427
460	0.05226	9568.8	13396.	198.50	21.11	29.45	437
480	0.05008	9992.0	13986.	199.76	21.19	29.53	446
500	0.04807	10417.	14577.	200.97	21.27	29.61	455
520	0.04622	10843.	15170.	202.13	21.36	29.70	464
540	0.04451	11272.	15765.	203.25	21.46	29.80	472
560	0.04292	11702.	16362.	204.34	21.57	29.90	480
580	0.04144	12135.	16961.	205.39	21.68	30.01	489
600	0.04006	12570.	17563.	206.41	21.80	30.13	497
620	0.03877	13007.	18166.	207.40	21.92	30.25	504
640	0.03755	13447.	18773.	208.36	22.05	30.37	512
660	0.03642	13889.	19381.	209.30	22.18	30.50	519
680	0.03535	14334.	19993.	210.21	22.31	30.63	527
700	0.03434	14782.	20607.	211.10	22.44	30.77	534
720	0.03338	15232.	21224.	211.97	22.58	30.90	541
740	0.03248	15685.	21843.	212.82	22.71	31.04	548
760	0.03163	16141.	22465.	213.65	22.85	31.17	555
780	0.03082	16600.	23090.	214.46	22.99	31.31	562
800	0.03005	17061.	23717.	215.25	23.12	31.44	569
850	0.02828	18225.	25298.	217.17	23.46	31.78	585
900	0.02671	19406.	26895.	218.99	23.78	32.10	601
950	0.02530	20603.	28507.	220.74	24.09	32.41	616
1000	0.02404	21815.	30135.	222.41	24.39	32.70	631
1050	0.02289	23042.	31778.	224.01	24.67	32.98	646
1100	0.02185	24282.	33433.	225.55	24.93	33.25	660

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1150	0.02090	25535.	35102.	227.03	25.18	33.49	674
1200	0.02003	26799.	36783.	228.46	25.41	33.73	688
1250	0.01923	28075.	38474.	229.85	25.63	33.95	701
1300	0.01849	29362.	40177.	231.18	25.83	34.15	715
1350	0.01781	30659.	41889.	232.47	26.03	34.34	728
1400	0.01717	31965.	43611.	233.73	26.21	34.52	740
1450	0.01658	33279.	45341.	234.94	26.37	34.69	753
1500	0.01603	34602.	47080.	236.12	26.53	34.85	765
1550	0.01551	35932.	48826.	237.26	26.68	34.99	777
1600	0.01503	37269.	50579.	238.38	26.82	35.13	789
1650	0.01457	38614.	52338.	239.46	26.95	35.26	801
1700	0.01414	39964.	54105.	240.51	27.07	35.38	812
1750	0.01374	41320.	55876.	241.54	27.18	35.50	824
1800	0.01336	42682.	57654.	242.54	27.29	35.60	835
1850	0.01300	44049.	59437.	243.52	27.39	35.71	846
1900	0.01266	45421.	61224.	244.47	27.49	35.80	857
1950	0.01233	46798.	63017.	245.40	27.58	35.89	868
2000	0.01202	48179.	64813.	246.31	27.66	35.98	879
			0.25 MPa Isobar				
* 63.19	31.055	-4227.9	-4219.9	67.89	31.31	56.53	1023
64	30.930	-4182.2	-4174.1	68.61	31.23	56.46	1012
66	30.621	-4069.5	-4061.3	70.34	31.04	56.36	985
68	30.309	-3956.9	-3948.6	72.02	30.85	56.36	960
70	29.995	-3844.2	-3835.9	73.66	30.65	56.42	935
72	29.678	-3731.3	-3722.9	75.25	30.45	56.55	912
74	29.357	-3618.1	-3609.6	76.80	30.25	56.74	889
76	29.031	-3504.5	-3495.9	78.32	30.04	56.98	866
78	28.700	-3390.4	-3381.7	79.80	29.84	57.27	844
80	28.363	-3275.6	-3266.8	81.26	29.63	57.61	822
82	28.020	-3160.1	-3151.2	82.68	29.43	58.01	800
84	27.669	-3043.8	-3034.7	84.09	29.22	58.46	778
* 85.92	27.325	-2931.2	-2922.1	85.41	29.03	58.96	757
* 85.92	0.38177	1654.5	2309.3	146.30	26.87	40.13	177
86	0.38128	1656.9	2312.6	146.34	26.74	39.94	178
88	0.36968	1712.3	2388.5	147.21	24.37	36.38	181
90	0.35918	1763.1	2459.1	148.01	23.05	34.38	185
92	0.34950	1811.3	2526.6	148.75	22.31	33.19	188
94	0.34049	1857.9	2592.2	149.45	21.87	32.46	191
96	0.33203	1903.6	2656.6	150.13	21.61	31.98	193
98	0.32406	1948.7	2720.2	150.79	21.45	31.64	196
100	0.31652	1993.4	2783.2	151.42	21.34	31.40	198

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
102	0.30937	2037.7	2845.8	152.04	21.27	31.21	201
104	0.30257	2081.8	2908.1	152.65	21.22	31.06	203
106	0.29610	2125.7	2970.0	153.24	21.18	30.93	205
108	0.28993	2169.5	3031.8	153.81	21.15	30.82	207
110	0.28403	2213.1	3093.3	154.38	21.13	30.72	210
112	0.27839	2256.6	3154.7	154.93	21.11	30.63	212
114	0.27298	2300.0	3215.8	155.47	21.09	30.55	214
116	0.26780	2343.3	3276.9	156.00	21.07	30.48	216
118	0.26283	2386.6	3337.8	156.52	21.06	30.41	218
120	0.25805	2429.7	3398.5	157.03	21.05	30.35	220
122	0.25345	2472.8	3459.1	157.54	21.03	30.29	222
124	0.24902	2515.8	3519.7	158.03	21.02	30.24	224
126	0.24476	2558.7	3580.1	158.51	21.01	30.19	226
128	0.24065	2601.6	3640.4	158.99	21.00	30.14	228
130	0.23668	2644.4	3700.7	159.45	20.99	30.10	230
132	0.23284	2687.1	3760.8	159.91	20.98	30.05	232
134	0.22914	2729.8	3820.9	160.36	20.97	30.02	234
136	0.22556	2772.5	3880.9	160.81	20.97	29.98	235
138	0.22209	2815.1	3940.8	161.25	20.96	29.94	237
140	0.21873	2857.7	4000.6	161.68	20.95	29.91	239
142	0.21548	2900.2	4060.4	162.10	20.94	29.88	241
144	0.21233	2942.8	4120.2	162.52	20.94	29.85	243
146	0.20927	2985.2	4179.8	162.93	20.93	29.82	245
148	0.20630	3027.7	4239.5	163.34	20.93	29.80	246
150	0.20342	3070.1	4299.0	163.74	20.92	29.77	248
155	0.19657	3175.9	4447.8	164.71	20.91	29.72	252
160	0.19018	3281.7	4596.2	165.65	20.90	29.67	257
165	0.18420	3387.2	4744.4	166.57	20.89	29.62	261
170	0.17860	3492.7	4892.4	167.45	20.88	29.58	265
175	0.17334	3598.0	5040.3	168.31	20.87	29.55	269
180	0.16839	3703.2	5187.9	169.14	20.87	29.52	273
185	0.16371	3808.4	5335.4	169.95	20.86	29.49	277
190	0.15930	3913.4	5482.8	170.73	20.86	29.46	280
195	0.15512	4018.4	5630.1	171.50	20.85	29.44	284
200	0.15116	4123.3	5777.2	172.24	20.85	29.42	288
210	0.14382	4333.0	6071.2	173.68	20.84	29.38	295
220	0.13718	4542.4	6364.9	175.04	20.84	29.35	302
230	0.13113	4751.7	6658.3	176.35	20.83	29.33	309
240	0.12559	4960.9	6951.4	177.59	20.83	29.31	316
250	0.12051	5169.9	7244.4	178.79	20.83	29.29	322
260	0.11583	5378.9	7537.2	179.94	20.82	29.27	329
270	0.11150	5587.8	7829.9	181.04	20.82	29.26	335
280	0.10749	5796.6	8122.4	182.11	20.82	29.25	341
290	0.10376	6005.4	8414.9	183.13	20.83	29.24	347
300	0.10027	6214.2	8707.3	184.13	20.83	29.24	353

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
310	0.09702	6422.9	8999.7	185.08	20.83	29.24	359
320	0.09397	6631.7	9292.1	186.01	20.84	29.23	365
330	0.09111	6840.5	9584.4	186.91	20.84	29.24	371
340	0.08842	7049.4	9876.8	187.78	20.85	29.24	376
350	0.08589	7258.3	10169.	188.63	20.86	29.24	382
360	0.08349	7467.3	10462.	189.46	20.87	29.25	387
370	0.08123	7676.4	10754.	190.26	20.89	29.26	392
380	0.07908	7885.7	11047.	191.04	20.90	29.27	398
390	0.07705	8095.1	11340.	191.80	20.92	29.29	403
400	0.07512	8304.7	11633.	192.54	20.94	29.31	408
420	0.07154	8724.5	12219.	193.97	20.99	29.35	418
440	0.06828	9145.2	12807.	195.34	21.05	29.40	427
460	0.06531	9567.2	13395.	196.65	21.11	29.46	437
480	0.06258	9990.5	13985.	197.90	21.19	29.53	446
500	0.06008	10415.	14577.	199.11	21.27	29.61	455
520	0.05777	10842.	15170.	200.27	21.36	29.70	464
540	0.05563	11271.	15765.	201.39	21.46	29.80	472
560	0.05364	11701.	16362.	202.48	21.57	29.91	481
580	0.05179	12134.	16961.	203.53	21.68	30.02	489
600	0.05006	12569.	17563.	204.55	21.80	30.13	497
620	0.04845	13006.	18166.	205.54	21.92	30.25	504
640	0.04693	13446.	18773.	206.50	22.05	30.38	512
660	0.04551	13888.	19382.	207.44	22.18	30.51	520
680	0.04417	14333.	19993.	208.35	22.31	30.64	527
700	0.04291	14781.	20607.	209.24	22.44	30.77	534
720	0.04172	15231.	21224.	210.11	22.58	30.91	541
740	0.04059	15685.	21843.	210.96	22.72	31.04	548
760	0.03952	16140.	22466.	211.79	22.85	31.18	555
780	0.03851	16599.	23090.	212.60	22.99	31.31	562
800	0.03755	17060.	23718.	213.40	23.12	31.45	569
850	0.03534	18225.	25299.	215.31	23.46	31.78	585
900	0.03338	19406.	26896.	217.14	23.78	32.10	601
950	0.03162	20603.	28508.	218.88	24.09	32.41	616
1000	0.03004	21815.	30136.	220.55	24.39	32.70	631
1050	0.02861	23041.	31779.	222.15	24.67	32.98	646
1100	0.02731	24281.	33434.	223.69	24.93	33.25	660
1150	0.02613	25534.	35103.	225.18	25.18	33.50	674
1200	0.02504	26799.	36784.	226.61	25.41	33.73	688
1250	0.02404	28075.	38476.	227.99	25.63	33.95	701
1300	0.02311	29362.	40178.	229.33	25.83	34.15	715
1350	0.02226	30659.	41891.	230.62	26.03	34.34	728
1400	0.02146	31964.	43612.	231.87	26.21	34.52	740
1450	0.02072	33279.	45343.	233.08	26.37	34.69	753
1500	0.02003	34602.	47081.	234.26	26.53	34.85	765
1550	0.01939	35932.	48827.	235.41	26.68	34.99	777

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1600	0.01878	37269.	50580.	236.52	26.82	35.13	789
1650	0.01821	38613.	52340.	237.60	26.95	35.26	801
1700	0.01768	39964.	54106.	238.66	27.07	35.38	813
1750	0.01717	41320.	55878.	239.69	27.18	35.50	824
1800	0.01670	42682.	57656.	240.69	27.29	35.60	835
1850	0.01624	44049.	59438.	241.66	27.39	35.71	846
1900	0.01582	45421.	61226.	242.62	27.49	35.80	857
1950	0.01541	46797.	63018.	243.55	27.58	35.89	868
2000	0.01503	48178.	64815.	244.46	27.66	35.98	879
			0.30 MPa Isobar				
* 63.20	31.056	-4227.9	-4218.2	67.89	31.31	56.53	1023
64	30.933	-4182.7	-4173.0	68.60	31.23	56.46	1012
66	30.624	-4070.0	-4060.2	70.33	31.04	56.36	985
68	30.313	-3957.4	-3947.5	72.02	30.85	56.35	960
70	29.999	-3844.8	-3834.8	73.65	30.65	56.41	936
72	29.682	-3732.0	-3721.9	75.24	30.45	56.54	912
74	29.361	-3618.8	-3608.6	76.79	30.25	56.72	889
76	29.036	-3505.3	-3494.9	78.31	30.05	56.96	867
78	28.705	-3391.2	-3380.7	79.79	29.84	57.25	844
80	28.368	-3276.5	-3265.9	81.24	29.63	57.59	822
82	28.025	-3161.0	-3150.3	82.67	29.43	57.99	801
84	27.675	-3044.7	-3033.9	84.07	29.22	58.44	779
86	27.317	-2927.5	-2916.5	85.46	29.02	58.96	757
* 87.90	26.968	-2815.1	-2803.9	86.75	28.84	59.52	736
* 87.90	0.45324	1677.9	2339.8	145.27	26.95	40.81	178
88	0.45250	1680.9	2343.8	145.32	26.79	40.57	178
90	0.43859	1737.0	2421.0	146.18	24.47	36.99	182
92	0.42601	1788.6	2492.8	146.97	23.16	34.94	186
94	0.41445	1837.5	2561.3	147.71	22.41	33.71	189
96	0.40369	1884.8	2627.9	148.41	21.97	32.93	192
98	0.39361	1931.1	2693.2	149.08	21.70	32.41	194
100	0.38412	1976.7	2757.7	149.73	21.53	32.04	197
102	0.37516	2021.8	2821.5	150.37	21.42	31.77	199
104	0.36667	2066.6	2884.8	150.98	21.34	31.55	202
106	0.35861	2111.1	2947.7	151.58	21.28	31.38	204
108	0.35094	2155.4	3010.3	152.17	21.24	31.23	206
110	0.34362	2199.6	3072.6	152.74	21.21	31.10	209
112	0.33664	2243.5	3134.7	153.30	21.18	30.98	211
114	0.32996	2287.4	3196.5	153.84	21.16	30.88	213
116	0.32357	2331.1	3258.2	154.38	21.14	30.79	215
118	0.31744	2374.7	3319.7	154.91	21.12	30.70	217

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
120	0.31156	2418.1	3381.0	155.42	21.10	30.62	219
122	0.30592	2461.5	3442.2	155.93	21.09	30.55	221
124	0.30048	2504.9	3503.2	156.42	21.07	30.49	223
126	0.29526	2548.1	3564.2	156.91	21.06	30.42	225
128	0.29022	2591.2	3624.9	157.39	21.04	30.36	227
130	0.28537	2634.3	3685.6	157.86	21.03	30.31	229
132	0.28068	2677.3	3746.2	158.32	21.02	30.26	231
134	0.27616	2720.3	3806.6	158.78	21.01	30.21	233
136	0.27178	2763.2	3867.0	159.22	21.00	30.16	235
138	0.26755	2806.0	3927.3	159.66	20.99	30.12	237
140	0.26346	2848.8	3987.5	160.10	20.98	30.08	239
142	0.25950	2891.6	4047.6	160.52	20.98	30.04	241
144	0.25566	2934.3	4107.7	160.94	20.97	30.01	242
146	0.25194	2976.9	4167.7	161.36	20.96	29.97	244
148	0.24834	3019.5	4227.6	161.76	20.95	29.94	246
150	0.24483	3062.1	4287.4	162.17	20.95	29.91	248
155	0.23651	3168.4	4436.8	163.15	20.93	29.84	252
160	0.22876	3274.5	4585.9	164.09	20.92	29.78	256
165	0.22152	3380.4	4734.7	165.01	20.91	29.73	260
170	0.21474	3486.1	4883.2	165.89	20.90	29.68	265
175	0.20837	3591.8	5031.5	166.75	20.89	29.64	269
180	0.20239	3697.3	5179.6	167.59	20.88	29.60	273
185	0.19674	3802.6	5327.5	168.40	20.88	29.57	276
190	0.19141	3907.9	5475.2	169.19	20.87	29.54	280
195	0.18637	4013.1	5622.8	169.95	20.86	29.51	284
200	0.18159	4118.2	5770.3	170.70	20.86	29.48	288
210	0.17274	4328.2	6064.9	172.14	20.85	29.44	295
220	0.16474	4538.0	6359.1	173.51	20.84	29.40	302
230	0.15745	4747.6	6653.0	174.81	20.84	29.37	309
240	0.15079	4957.0	6946.5	176.06	20.83	29.35	316
250	0.14467	5166.2	7239.9	177.26	20.83	29.32	322
260	0.13904	5375.4	7533.0	178.41	20.83	29.31	329
270	0.13384	5584.5	7826.0	179.52	20.83	29.29	335
280	0.12901	5793.5	8118.9	180.58	20.83	29.28	341
290	0.12452	6002.4	8411.6	181.61	20.83	29.27	347
300	0.12034	6211.3	8704.2	182.60	20.83	29.26	353
310	0.11643	6420.2	8996.8	183.56	20.84	29.26	359
320	0.11277	6629.1	9289.4	184.49	20.84	29.25	365
330	0.10933	6838.0	9581.9	185.39	20.85	29.25	371
340	0.10610	7047.0	9874.4	186.26	20.86	29.26	376
350	0.10306	7256.0	10167.	187.11	20.87	29.26	382
360	0.10018	7465.1	10460.	187.93	20.88	29.27	387
370	0.09746	7674.3	10752.	188.74	20.89	29.28	393
380	0.09489	7883.6	11045.	189.52	20.91	29.29	398
390	0.09245	8093.1	11338.	190.28	20.92	29.30	403

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
400	0.09013	8302.7	11631.	191.02	20.95	29.32	408
420	0.08583	8722.6	12218.	192.45	20.99	29.36	418
440	0.08192	9143.5	12806.	193.82	21.05	29.41	428
460	0.07835	9565.6	13394.	195.13	21.11	29.47	437
480	0.07509	9989.0	13984.	196.38	21.19	29.54	446
500	0.07208	10414.	14576.	197.59	21.27	29.62	455
520	0.06930	10841.	15169.	198.75	21.36	29.71	464
540	0.06674	11269.	15765.	199.88	21.46	29.81	472
560	0.06435	11700.	16362.	200.96	21.57	29.91	481
580	0.06213	12133.	16961.	202.01	21.68	30.02	489
600	0.06006	12568.	17563.	203.03	21.80	30.14	497
620	0.05812	13005.	18167.	204.02	21.92	30.26	505
640	0.05631	13445.	18773.	204.99	22.05	30.38	512
660	0.05460	13887.	19382.	205.92	22.18	30.51	520
680	0.05300	14333.	19993.	206.84	22.31	30.64	527
700	0.05148	14780.	20608.	207.73	22.45	30.77	534
720	0.05005	15231.	21224.	208.59	22.58	30.91	542
740	0.04870	15684.	21844.	209.44	22.72	31.04	549
760	0.04742	16140.	22466.	210.27	22.85	31.18	555
780	0.04620	16598.	23091.	211.08	22.99	31.31	562
800	0.04505	17059.	23719.	211.88	23.12	31.45	569
850	0.04240	18224.	25299.	213.80	23.46	31.78	585
900	0.04005	19405.	26896.	215.62	23.78	32.10	601
950	0.03794	20602.	28509.	217.37	24.09	32.41	617
1000	0.03605	21814.	30137.	219.04	24.39	32.71	632
1050	0.03433	23041.	31780.	220.64	24.67	32.99	646
1100	0.03277	24281.	33436.	222.18	24.93	33.25	660
1150	0.03135	25534.	35104.	223.66	25.18	33.50	674
1200	0.03004	26799.	36785.	225.09	25.41	33.73	688
1250	0.02884	28075.	38477.	226.47	25.63	33.95	702
1300	0.02773	29362.	40179.	227.81	25.84	34.15	715
1350	0.02671	30658.	41892.	229.10	26.03	34.34	728
1400	0.02575	31964.	43614.	230.35	26.21	34.52	740
1450	0.02487	33279.	45344.	231.57	26.37	34.69	753
1500	0.02404	34602.	47082.	232.75	26.53	34.85	765
1550	0.02326	35932.	48828.	233.89	26.68	34.99	777
1600	0.02254	37269.	50582.	235.01	26.82	35.13	789
1650	0.02185	38613.	52341.	236.09	26.95	35.26	801
1700	0.02121	39964.	54107.	237.14	27.07	35.38	813
1750	0.02061	41320.	55879.	238.17	27.18	35.50	824
1800	0.02003	42682.	57657.	239.17	27.29	35.60	835
1850	0.01949	44049.	59440.	240.15	27.39	35.71	847
1900	0.01898	45421.	61227.	241.10	27.49	35.80	858
1950	0.01849	46797.	63020.	242.03	27.58	35.89	868
2000	0.01803	48178.	64817.	242.94	27.66	35.98	879

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
			0.40 MPa Isobar				
* 63.22	31.059	-4227.7	-4214.8	67.89	31.31	56.51	1024
64	30.939	-4183.8	-4170.8	68.58	31.24	56.44	1013
66	30.631	-4071.1	-4058.1	70.32	31.05	56.34	986
68	30.320	-3958.6	-3945.4	72.00	30.86	56.33	961
70	30.007	-3846.0	-3832.7	73.63	30.66	56.39	936
72	29.690	-3733.3	-3719.8	75.22	30.46	56.52	913
74	29.370	-3620.2	-3606.6	76.77	30.26	56.70	890
76	29.045	-3506.7	-3493.0	78.29	30.05	56.94	867
78	28.714	-3392.7	-3378.8	79.77	29.84	57.22	845
80	28.378	-3278.1	-3264.0	81.22	29.64	57.56	824
82	28.036	-3162.8	-3148.5	82.65	29.43	57.95	802
84	27.687	-3046.7	-3032.2	84.05	29.23	58.39	780
86	27.329	-2929.6	-2914.9	85.43	29.02	58.90	758
88	26.963	-2811.4	-2796.6	86.79	28.83	59.49	736
90	26.587	-2692.0	-2676.9	88.14	28.64	60.16	714
* 91.23	26.351	-2618.1	-2602.9	88.95	28.53	60.62	700
* 91.23	0.59569	1712.6	2384.1	143.62	27.05	42.10	179
92	0.58811	1735.8	2416.0	143.97	26.00	40.39	181
94	0.57001	1791.7	2493.5	144.80	24.14	37.35	185
96	0.55361	1843.7	2566.2	145.57	23.07	35.53	188
98	0.53852	1893.3	2636.0	146.29	22.44	34.39	192
100	0.52450	1941.4	2704.0	146.98	22.05	33.63	194
102	0.51138	1988.5	2770.7	147.64	21.80	33.09	197
104	0.49904	2034.9	2836.5	148.28	21.64	32.70	200
106	0.48741	2080.9	2901.5	148.89	21.53	32.39	202
108	0.47640	2126.4	2966.0	149.50	21.45	32.14	205
110	0.46595	2171.7	3030.1	150.09	21.39	31.93	207
112	0.45602	2216.6	3093.8	150.66	21.34	31.75	209
114	0.44657	2261.4	3157.1	151.22	21.30	31.59	211
116	0.43754	2306.0	3220.2	151.77	21.27	31.45	214
118	0.42892	2350.4	3282.9	152.30	21.24	31.33	216
120	0.42067	2394.6	3345.5	152.83	21.22	31.21	218
122	0.41277	2438.7	3407.8	153.35	21.19	31.10	220
124	0.40519	2482.7	3469.9	153.85	21.17	31.01	222
126	0.39791	2526.6	3531.8	154.35	21.15	30.92	224
128	0.39091	2570.3	3593.6	154.83	21.14	30.83	226
130	0.38418	2614.0	3655.2	155.31	21.12	30.75	228
132	0.37769	2657.5	3716.6	155.78	21.10	30.68	230
134	0.37144	2701.0	3777.9	156.24	21.09	30.61	232
136	0.36540	2744.4	3839.0	156.69	21.08	30.55	234

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
138	0.35958	2787.7	3900.1	157.14	21.06	30.49	236
140	0.35395	2830.9	3961.0	157.58	21.05	30.43	238
142	0.34851	2874.1	4021.8	158.01	21.04	30.38	240
144	0.34324	2917.2	4082.5	158.43	21.03	30.33	242
146	0.33814	2960.2	4143.1	158.85	21.02	30.28	243
148	0.33320	3003.2	4203.7	159.26	21.01	30.24	245
150	0.32842	3046.1	4264.1	159.67	21.00	30.20	247
155	0.31706	3153.2	4414.8	160.66	20.98	30.10	251
160	0.30650	3260.1	4565.1	161.61	20.96	30.02	256
165	0.29665	3366.7	4715.0	162.53	20.95	29.94	260
170	0.28745	3473.1	4864.6	163.43	20.94	29.88	264
175	0.27882	3579.2	5013.9	164.29	20.92	29.82	268
180	0.27071	3685.3	5162.8	165.13	20.91	29.77	272
185	0.26308	3791.1	5311.6	165.95	20.90	29.72	276
190	0.25588	3896.9	5460.1	166.74	20.89	29.68	280
195	0.24908	4002.5	5608.4	167.51	20.89	29.64	284
200	0.24264	4108.0	5756.5	168.26	20.88	29.61	288
210	0.23073	4318.7	6052.3	169.70	20.87	29.55	295
220	0.21997	4529.1	6347.5	171.07	20.86	29.50	302
230	0.21018	4739.2	6642.3	172.38	20.85	29.46	309
240	0.20124	4949.1	6936.8	173.64	20.85	29.42	316
250	0.19305	5158.8	7230.8	174.84	20.84	29.40	322
260	0.18550	5368.4	7524.7	175.99	20.84	29.37	329
270	0.17853	5577.8	7818.3	177.10	20.84	29.35	335
280	0.17208	5787.1	8111.7	178.17	20.84	29.33	342
290	0.16607	5996.4	8404.9	179.20	20.84	29.32	348
300	0.16048	6205.6	8698.1	180.19	20.84	29.31	354
310	0.15526	6414.7	8991.1	181.15	20.84	29.30	359
320	0.15036	6623.8	9284.0	182.08	20.85	29.29	365
330	0.14577	6833.0	9576.9	182.98	20.85	29.29	371
340	0.14146	7042.1	9869.8	183.86	20.86	29.29	377
350	0.13739	7251.3	10163.	184.70	20.87	29.29	382
360	0.13355	7460.6	10456.	185.53	20.88	29.30	387
370	0.12993	7670.0	10749.	186.33	20.90	29.30	393
380	0.12649	7879.5	11042.	187.11	20.91	29.31	398
390	0.12323	8089.1	11335.	187.88	20.93	29.33	403
400	0.12014	8298.9	11628.	188.62	20.95	29.34	408
420	0.11440	8719.0	12215.	190.05	21.00	29.38	418
440	0.10919	9140.1	12803.	191.42	21.05	29.43	428
460	0.10443	9562.4	13393.	192.73	21.12	29.49	437
480	0.10007	9986.0	13983.	193.98	21.19	29.56	446
500	0.09607	10411.	14575.	195.19	21.28	29.63	455
520	0.09237	10838.	15168.	196.36	21.37	29.72	464
540	0.08894	11267.	15764.	197.48	21.47	29.82	473
560	0.08577	11697.	16361.	198.57	21.57	29.92	481

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
580	0.08281	12130.	16961.	199.62	21.68	30.03	489
600	0.08005	12566.	17563.	200.64	21.80	30.15	497
620	0.07747	13003.	18167.	201.63	21.93	30.27	505
640	0.07505	13443.	18773.	202.59	22.05	30.39	513
660	0.07277	13886.	19382.	203.53	22.18	30.52	520
680	0.07063	14331.	19994.	204.44	22.31	30.65	527
700	0.06862	14779.	20608.	205.33	22.45	30.78	535
720	0.06671	15229.	21225.	206.20	22.58	30.91	542
740	0.06491	15682.	21845.	207.05	22.72	31.05	549
760	0.06320	16138.	22467.	207.88	22.85	31.18	556
780	0.06158	16597.	23092.	208.69	22.99	31.32	562
800	0.06004	17058.	23720.	209.49	23.12	31.45	569
850	0.05651	18223.	25301.	211.40	23.46	31.78	586
900	0.05338	19404.	26898.	213.23	23.78	32.11	601
950	0.05057	20601.	28511.	214.97	24.09	32.41	617
1000	0.04804	21813.	30139.	216.64	24.39	32.71	632
1050	0.04576	23040.	31782.	218.25	24.67	32.99	646
1100	0.04368	24280.	33438.	219.79	24.93	33.25	661
1150	0.04178	25533.	35107.	221.27	25.18	33.50	675
1200	0.04004	26798.	36787.	222.70	25.41	33.73	688
1250	0.03844	28074.	38479.	224.08	25.63	33.95	702
1300	0.03697	29361.	40182.	225.42	25.84	34.15	715
1350	0.03560	30658.	41894.	226.71	26.03	34.34	728
1400	0.03433	31964.	43616.	227.96	26.21	34.52	741
1450	0.03315	33278.	45347.	229.18	26.37	34.69	753
1500	0.03204	34601.	47085.	230.36	26.53	34.85	765
1550	0.03101	35932.	48831.	231.50	26.68	34.99	778
1600	0.03004	37269.	50584.	232.61	26.82	35.13	789
1650	0.02913	38613.	52344.	233.70	26.95	35.26	801
1700	0.02827	39964.	54110.	234.75	27.07	35.38	813
1750	0.02747	41320.	55882.	235.78	27.18	35.50	824
1800	0.02671	42682.	57660.	236.78	27.29	35.60	836
1850	0.02598	44049.	59443.	237.76	27.39	35.71	847
1900	0.02530	45421.	61231.	238.71	27.49	35.80	858
1950	0.02465	46797.	63023.	239.64	27.58	35.89	869
2000	0.02404	48178.	64820.	240.55	27.66	35.98	879
			0.50 MPa Isobar				
* 63.24	31.062	-4227.5	-4211.4	67.89	31.32	56.50	1024
64	30.945	-4184.8	-4168.6	68.57	31.25	56.43	1014
66	30.637	-4072.2	-4055.9	70.30	31.06	56.33	987
68	30.327	-3959.7	-3943.3	71.98	30.86	56.31	962

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
70	30.014	-3847.2	-3830.6	73.61	30.67	56.37	937
72	29.698	-3734.6	-3717.7	75.20	30.47	56.50	914
74	29.378	-3621.6	-3604.6	76.75	30.26	56.68	891
76	29.053	-3508.2	-3491.0	78.27	30.05	56.91	868
78	28.724	-3394.3	-3376.9	79.75	29.85	57.19	846
80	28.389	-3279.8	-3262.2	81.20	29.64	57.52	825
82	28.047	-3164.6	-3146.8	82.63	29.43	57.91	803
84	27.698	-3048.6	-3030.5	84.03	29.23	58.35	781
86	27.342	-2931.6	-2913.3	85.41	29.03	58.85	759
88	26.977	-2813.6	-2795.1	86.77	28.83	59.43	738
90	26.601	-2694.4	-2675.6	88.11	28.64	60.09	715
92	26.215	-2573.7	-2554.7	89.44	28.46	60.85	693
* 93.99	25.818	-2452.2	-2432.8	90.75	28.29	61.73	670
* 93.99	0.73843	1736.5	2413.6	142.32	27.14	43.41	180
94	0.73827	1736.9	2414.2	142.32	27.12	43.38	180
96	0.71410	1796.5	2496.7	143.19	24.88	39.52	184
98	0.69247	1851.2	2573.3	143.98	23.59	37.22	188
100	0.67274	1902.9	2646.1	144.72	22.82	35.76	191
102	0.65454	1952.7	2716.6	145.41	22.34	34.79	194
104	0.63761	2001.3	2785.5	146.08	22.04	34.10	197
106	0.62176	2049.0	2853.2	146.73	21.84	33.60	200
108	0.60687	2096.0	2919.9	147.35	21.70	33.20	202
110	0.59283	2142.6	2986.0	147.96	21.60	32.88	205
112	0.57954	2188.8	3051.5	148.55	21.53	32.61	207
114	0.56695	2234.6	3116.5	149.12	21.47	32.38	210
116	0.55498	2280.1	3181.0	149.68	21.42	32.18	212
118	0.54358	2325.4	3245.2	150.23	21.38	32.00	214
120	0.53271	2370.5	3309.1	150.77	21.34	31.84	217
122	0.52232	2415.3	3372.6	151.29	21.31	31.70	219
124	0.51239	2460.0	3435.9	151.81	21.28	31.56	221
126	0.50287	2504.6	3498.9	152.31	21.26	31.44	223
128	0.49375	2549.0	3561.6	152.81	21.23	31.33	225
130	0.48498	2593.2	3624.2	153.29	21.21	31.22	227
132	0.47656	2637.3	3686.5	153.77	21.19	31.13	229
134	0.46845	2681.4	3748.7	154.24	21.17	31.04	231
136	0.46064	2725.2	3810.7	154.69	21.15	30.95	233
138	0.45311	2769.0	3872.5	155.15	21.14	30.87	235
140	0.44585	2812.7	3934.2	155.59	21.12	30.80	237
142	0.43884	2856.3	3995.7	156.03	21.11	30.73	239
144	0.43206	2899.9	4057.1	156.46	21.09	30.67	241
146	0.42551	2943.3	4118.4	156.88	21.08	30.60	243
148	0.41917	2986.7	4179.5	157.29	21.07	30.55	245
150	0.41302	3030.0	4240.6	157.70	21.06	30.49	246
155	0.39848	3138.0	4392.7	158.70	21.03	30.37	251
160	0.38500	3245.6	4544.3	159.66	21.01	30.26	255

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
165	0.37244	3352.9	4695.3	160.59	20.99	30.17	260
170	0.36073	3459.9	4845.9	161.49	20.97	30.08	264
175	0.34977	3566.7	4996.2	162.36	20.96	30.01	268
180	0.33948	3673.2	5146.0	163.21	20.94	29.94	272
185	0.32981	3779.6	5295.6	164.03	20.93	29.88	276
190	0.32070	3885.8	5444.9	164.82	20.92	29.83	280
195	0.31209	3991.8	5593.9	165.60	20.91	29.78	284
200	0.30396	4097.7	5742.7	166.35	20.90	29.74	287
210	0.28893	4309.1	6039.7	167.80	20.89	29.66	295
220	0.27536	4520.2	6336.0	169.18	20.88	29.60	302
230	0.26304	4730.8	6631.7	170.49	20.87	29.55	309
240	0.25180	4941.2	6927.0	171.75	20.86	29.50	316
250	0.24150	5151.4	7221.8	172.95	20.85	29.47	323
260	0.23202	5361.3	7516.3	174.11	20.85	29.44	329
270	0.22327	5571.1	7810.5	175.22	20.85	29.41	335
280	0.21517	5780.8	8104.5	176.29	20.84	29.39	342
290	0.20765	5990.3	8398.3	177.32	20.84	29.37	348
300	0.20064	6199.8	8691.9	178.31	20.85	29.35	354
310	0.19409	6409.2	8985.3	179.28	20.85	29.34	360
320	0.18796	6618.6	9278.7	180.21	20.85	29.33	365
330	0.18221	6827.9	9572.0	181.11	20.86	29.33	371
340	0.17681	7037.3	9865.2	181.99	20.87	29.32	377
350	0.17172	7246.7	10158.	182.84	20.88	29.32	382
360	0.16691	7456.1	10452.	183.66	20.89	29.33	388
370	0.16237	7665.7	10745.	184.47	20.90	29.33	393
380	0.15808	7875.3	11038.	185.25	20.92	29.34	398
390	0.15400	8085.1	11332.	186.01	20.93	29.35	403
400	0.15014	8295.0	11625.	186.75	20.95	29.36	408
420	0.14296	8715.4	12213.	188.19	21.00	29.40	418
440	0.13644	9136.8	12801.	189.56	21.05	29.45	428
460	0.13049	9559.2	13391.	190.87	21.12	29.50	438
480	0.12505	9983.0	13982.	192.12	21.19	29.57	447
500	0.12004	10408.	14574.	193.33	21.28	29.65	456
520	0.11541	10835.	15168.	194.50	21.37	29.73	464
540	0.11114	11264.	15763.	195.62	21.47	29.83	473
560	0.10716	11695.	16361.	196.71	21.57	29.93	481
580	0.10347	12128.	16961.	197.76	21.69	30.04	489
600	0.10002	12563.	17562.	198.78	21.80	30.15	497
620	0.09679	13001.	18167.	199.77	21.93	30.27	505
640	0.09377	13441.	18773.	200.73	22.05	30.40	513
660	0.09093	13884.	19383.	201.67	22.18	30.53	520
680	0.08825	14329.	19994.	202.58	22.31	30.65	528
700	0.08573	14777.	20609.	203.47	22.45	30.79	535
720	0.08335	15227.	21226.	204.34	22.58	30.92	542
740	0.08110	15681.	21846.	205.19	22.72	31.05	549

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
760	0.07897	16137.	22468.	206.02	22.85	31.19	556
780	0.07695	16595.	23093.	206.83	22.99	31.32	563
800	0.07502	17057.	23721.	207.63	23.13	31.46	569
850	0.07062	18222.	25302.	209.55	23.46	31.79	586
900	0.06670	19403.	26900.	211.37	23.78	32.11	602
950	0.06319	20600.	28513.	213.12	24.09	32.42	617
1000	0.06003	21813.	30141.	214.79	24.39	32.71	632
1050	0.05718	23039.	31784.	216.39	24.67	32.99	647
1100	0.05458	24279.	33440.	217.93	24.93	33.25	661
1150	0.05221	25532.	35109.	219.41	25.18	33.50	675
1200	0.05004	26798.	36790.	220.84	25.41	33.73	689
1250	0.04804	28074.	38482.	222.23	25.63	33.95	702
1300	0.04619	29361.	40185.	223.56	25.84	34.15	715
1350	0.04449	30657.	41897.	224.85	26.03	34.35	728
1400	0.04290	31963.	43619.	226.11	26.21	34.52	741
1450	0.04142	33278.	45349.	227.32	26.37	34.69	753
1500	0.04004	34601.	47088.	228.50	26.53	34.85	766
1550	0.03875	35931.	48834.	229.64	26.68	35.00	778
1600	0.03754	37269.	50587.	230.76	26.82	35.13	790
1650	0.03641	38613.	52347.	231.84	26.95	35.26	801
1700	0.03534	39963.	54113.	232.90	27.07	35.38	813
1750	0.03433	41320.	55885.	233.92	27.18	35.50	824
1800	0.03337	42682.	57663.	234.92	27.29	35.61	836
1850	0.03247	44049.	59446.	235.90	27.39	35.71	847
1900	0.03162	45421.	61234.	236.86	27.49	35.80	858
1950	0.03081	46797.	63026.	237.79	27.58	35.89	869
2000	0.03004	48178.	64823.	238.70	27.66	35.98	879
			0.60 MPa Isobar				
* 63.26	31.065	-4227.3	-4208.0	67.90	31.32	56.49	1025
64	30.952	-4185.8	-4166.4	68.55	31.25	56.42	1014
66	30.644	-4073.3	-4053.7	70.28	31.06	56.31	988
68	30.334	-3960.9	-3941.1	71.96	30.87	56.30	962
70	30.022	-3848.5	-3828.5	73.60	30.67	56.35	938
72	29.706	-3735.9	-3715.7	75.19	30.47	56.47	915
74	29.386	-3623.0	-3602.5	76.74	30.27	56.65	892
76	29.062	-3509.7	-3489.0	78.25	30.06	56.88	869
78	28.733	-3395.9	-3375.0	79.73	29.85	57.16	847
80	28.399	-3281.5	-3260.4	81.18	29.64	57.49	826
82	28.058	-3166.4	-3145.0	82.61	29.44	57.87	804
84	27.710	-3050.5	-3028.9	84.01	29.23	58.30	782
86	27.354	-2933.7	-2911.8	85.38	29.03	58.80	761

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
88	26.990	-2815.8	-2793.6	86.74	28.83	59.37	739
90	26.616	-2696.8	-2674.2	88.08	28.64	60.02	717
92	26.231	-2576.4	-2553.5	89.41	28.46	60.77	694
94	25.833	-2454.3	-2431.1	90.73	28.28	61.64	671
96	25.421	-2330.4	-2306.8	92.03	28.13	62.67	647
* 96.37	25.343	-2307.1	-2283.4	92.28	28.10	62.88	643
* 96.37	0.88221	1753.1	2433.2	141.22	27.23	44.78	180
98	0.85759	1803.5	2503.1	141.94	25.36	41.36	184
100	0.83042	1860.4	2583.0	142.75	23.95	38.70	188
102	0.80584	1914.0	2658.5	143.50	23.10	37.01	192
104	0.78329	1965.4	2731.4	144.20	22.58	35.87	195
106	0.76242	2015.3	2802.2	144.88	22.24	35.06	198
108	0.74297	2064.1	2871.7	145.53	22.01	34.45	200
110	0.72474	2112.3	2940.1	146.16	21.85	33.97	203
112	0.70762	2159.8	3007.7	146.76	21.74	33.59	206
114	0.69146	2206.8	3074.5	147.36	21.65	33.26	208
116	0.67617	2253.4	3140.8	147.93	21.58	32.99	210
118	0.66166	2299.7	3206.5	148.49	21.52	32.74	213
120	0.64788	2345.7	3271.8	149.04	21.47	32.53	215
122	0.63476	2391.4	3336.6	149.58	21.43	32.34	217
124	0.62224	2436.9	3401.1	150.10	21.39	32.16	220
126	0.61028	2482.1	3465.3	150.62	21.36	32.00	222
128	0.59884	2527.2	3529.1	151.12	21.33	31.86	224
130	0.58788	2572.1	3592.7	151.61	21.30	31.72	226
132	0.57737	2616.8	3656.0	152.09	21.28	31.60	228
134	0.56727	2661.4	3719.1	152.57	21.25	31.48	230
136	0.55756	2705.8	3781.9	153.03	21.23	31.37	232
138	0.54821	2750.1	3844.6	153.49	21.21	31.27	234
140	0.53921	2794.3	3907.0	153.94	21.19	31.18	236
142	0.53053	2838.4	3969.3	154.38	21.17	31.09	238
144	0.52216	2882.3	4031.4	154.82	21.16	31.01	240
146	0.51407	2926.2	4093.4	155.24	21.14	30.94	242
148	0.50625	2970.0	4155.2	155.66	21.13	30.86	244
150	0.49869	3013.7	4216.8	156.08	21.11	30.80	246
155	0.48081	3122.5	4370.4	157.09	21.08	30.64	250
160	0.46427	3230.9	4523.3	158.06	21.05	30.51	255
165	0.44891	3338.9	4675.5	158.99	21.03	30.39	259
170	0.43459	3446.6	4827.2	159.90	21.01	30.29	263
175	0.42122	3554.0	4978.4	160.78	20.99	30.20	268
180	0.40869	3661.1	5129.2	161.63	20.97	30.12	272
185	0.39693	3768.0	5279.6	162.45	20.96	30.04	276
190	0.38585	3874.6	5429.6	163.25	20.95	29.98	280
195	0.37541	3981.1	5579.4	164.03	20.93	29.92	284
200	0.36553	4087.4	5728.8	164.78	20.92	29.87	287
210	0.34733	4299.6	6027.0	166.24	20.91	29.78	295

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
220	0.33091	4511.2	6324.4	167.62	20.89	29.70	302
230	0.31602	4722.5	6621.1	168.94	20.88	29.64	309
240	0.30244	4933.4	6917.2	170.20	20.87	29.58	316
250	0.29002	5144.0	7212.8	171.41	20.87	29.54	323
260	0.27859	5354.3	7508.0	172.57	20.86	29.50	329
270	0.26805	5564.5	7802.8	173.68	20.86	29.47	336
280	0.25830	5774.5	8097.4	174.75	20.85	29.44	342
290	0.24924	5984.3	8391.7	175.78	20.85	29.42	348
300	0.24080	6194.0	8685.7	176.78	20.85	29.40	354
310	0.23293	6403.7	8979.6	177.74	20.85	29.38	360
320	0.22556	6613.3	9273.4	178.68	20.86	29.37	366
330	0.21865	6822.9	9567.0	179.58	20.86	29.36	371
340	0.21215	7032.4	9860.6	180.46	20.87	29.36	377
350	0.20603	7242.0	10154.	181.31	20.88	29.35	382
360	0.20026	7451.7	10448.	182.13	20.89	29.35	388
370	0.19481	7661.4	10741.	182.94	20.90	29.36	393
380	0.18965	7871.2	11035.	183.72	20.92	29.36	398
390	0.18476	8081.1	11329.	184.48	20.94	29.37	404
400	0.18011	8291.1	11622.	185.23	20.96	29.39	409
420	0.17150	8711.8	12210.	186.66	21.00	29.42	419
440	0.16367	9133.4	12799.	188.03	21.06	29.46	428
460	0.15653	9556.0	13389.	189.34	21.12	29.52	438
480	0.15000	9980.0	13980.	190.60	21.20	29.59	447
500	0.14399	10405.	14573.	191.81	21.28	29.66	456
520	0.13844	10833.	15167.	192.97	21.37	29.75	465
540	0.13331	11262.	15763.	194.10	21.47	29.84	473
560	0.12854	11693.	16360.	195.19	21.58	29.94	481
580	0.12411	12126.	16960.	196.24	21.69	30.05	490
600	0.11997	12561.	17562.	197.26	21.81	30.16	498
620	0.11610	12999.	18167.	198.25	21.93	30.28	505
640	0.11247	13439.	18774.	199.21	22.05	30.41	513
660	0.10907	13882.	19383.	200.15	22.18	30.53	521
680	0.10586	14327.	19995.	201.06	22.32	30.66	528
700	0.10284	14775.	20610.	201.96	22.45	30.79	535
720	0.09998	15226.	21227.	202.83	22.58	30.93	542
740	0.09728	15679.	21847.	203.67	22.72	31.06	549
760	0.09473	16135.	22469.	204.50	22.86	31.19	556
780	0.09230	16594.	23094.	205.32	22.99	31.33	563
800	0.08999	17055.	23722.	206.11	23.13	31.46	570
850	0.08471	18220.	25304.	208.03	23.46	31.79	586
900	0.08001	19402.	26901.	209.85	23.78	32.11	602
950	0.07580	20599.	28515.	211.60	24.09	32.42	617
1000	0.07202	21812.	30143.	213.27	24.39	32.71	632
1050	0.06859	23038.	31786.	214.87	24.67	32.99	647
1100	0.06548	24279.	33442.	216.41	24.93	33.26	661

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1150	0.06264	25532.	35111.	217.90	25.18	33.50	675
1200	0.06003	26797.	36792.	219.33	25.41	33.73	689
1250	0.05763	28073.	38484.	220.71	25.63	33.95	702
1300	0.05542	29360.	40187.	222.05	25.84	34.16	715
1350	0.05337	30657.	41900.	223.34	26.03	34.35	728
1400	0.05146	31963.	43622.	224.59	26.21	34.53	741
1450	0.04969	33278.	45352.	225.80	26.38	34.69	754
1500	0.04804	34601.	47091.	226.98	26.53	34.85	766
1550	0.04649	35931.	48837.	228.13	26.68	35.00	778
1600	0.04504	37268.	50590.	229.24	26.82	35.13	790
1650	0.04368	38613.	52350.	230.33	26.95	35.26	802
1700	0.04239	39963.	54116.	231.38	27.07	35.38	813
1750	0.04118	41320.	55888.	232.41	27.18	35.50	825
1800	0.04004	42681.	57666.	233.41	27.29	35.61	836
1850	0.03896	44049.	59449.	234.39	27.39	35.71	847
1900	0.03794	45421.	61237.	235.34	27.49	35.80	858
1950	0.03696	46797.	63029.	236.27	27.58	35.89	869
2000	0.03604	48178.	64826.	237.18	27.66	35.98	880
			0.80 MPa Isobar				
* 63.31	31.070	-4226.9	-4201.1	67.90	31.34	56.46	1026
64	30.964	-4187.8	-4162.0	68.52	31.27	56.40	1016
66	30.657	-4075.4	-4049.3	70.25	31.08	56.29	989
68	30.348	-3963.2	-3936.8	71.93	30.88	56.26	964
70	30.037	-3850.9	-3824.2	73.56	30.68	56.32	940
72	29.722	-3738.4	-3711.5	75.15	30.48	56.43	916
74	29.403	-3625.7	-3598.5	76.70	30.28	56.60	894
76	29.080	-3512.6	-3485.1	78.21	30.07	56.82	871
78	28.752	-3399.0	-3371.2	79.69	29.86	57.10	849
80	28.419	-3284.8	-3256.7	81.14	29.65	57.42	828
82	28.079	-3169.9	-3141.5	82.56	29.44	57.79	806
84	27.733	-3054.3	-3025.5	83.96	29.23	58.21	785
86	27.379	-2937.8	-2908.6	85.33	29.03	58.69	763
88	27.017	-2820.3	-2790.6	86.69	28.83	59.25	741
90	26.645	-2701.6	-2671.5	88.03	28.64	59.88	720
92	26.262	-2581.5	-2551.1	89.35	28.45	60.61	697
94	25.868	-2459.9	-2429.0	90.66	28.28	61.45	674
96	25.459	-2336.6	-2305.1	91.97	28.12	62.45	651
98	25.034	-2211.1	-2179.1	93.27	27.97	63.63	627
100	24.589	-2083.0	-2050.5	94.57	27.84	65.05	601
* 100.39	24.500	-2057.8	-2025.2	94.82	27.82	65.36	596
* 100.39	1.1750	1771.1	2451.9	139.42	27.45	47.80	181

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
102	1.1399	1823.9	2525.7	140.15	25.66	44.07	185
104	1.1013	1884.2	2610.6	140.97	24.27	41.07	189
106	1.0667	1940.7	2690.7	141.74	23.42	39.10	192
108	1.0352	1994.6	2767.5	142.45	22.88	37.74	196
110	1.0062	2046.9	2841.9	143.14	22.52	36.75	199
112	0.97948	2097.8	2914.6	143.79	22.27	35.99	202
114	0.95454	2147.9	2986.0	144.42	22.09	35.38	204
116	0.93121	2197.1	3056.2	145.03	21.96	34.88	207
118	0.90929	2245.7	3125.5	145.63	21.86	34.46	210
120	0.88864	2293.8	3194.1	146.20	21.77	34.10	212
122	0.86912	2341.5	3261.9	146.76	21.70	33.78	215
124	0.85062	2388.7	3329.2	147.31	21.64	33.50	217
126	0.83306	2435.6	3395.9	147.85	21.59	33.24	219
128	0.81635	2482.2	3462.2	148.37	21.54	33.01	222
130	0.80042	2528.5	3528.0	148.88	21.50	32.81	224
132	0.78521	2574.6	3593.4	149.38	21.46	32.62	226
134	0.77066	2620.4	3658.5	149.87	21.43	32.44	228
136	0.75673	2666.0	3723.2	150.35	21.39	32.28	230
138	0.74337	2711.4	3787.6	150.82	21.37	32.13	233
140	0.73055	2756.7	3851.7	151.28	21.34	31.99	235
142	0.71822	2801.7	3915.6	151.73	21.31	31.87	237
144	0.70636	2846.6	3979.2	152.17	21.29	31.75	239
146	0.69493	2891.4	4042.6	152.61	21.27	31.63	241
148	0.68391	2936.0	4105.8	153.04	21.25	31.53	243
150	0.67328	2980.5	4168.7	153.46	21.23	31.43	245
155	0.64826	3091.2	4325.3	154.49	21.18	31.21	249
160	0.62521	3201.3	4480.9	155.48	21.14	31.02	254
165	0.60389	3310.8	4635.6	156.43	21.11	30.86	258
170	0.58411	3419.9	4789.5	157.35	21.08	30.71	263
175	0.56568	3528.5	4942.7	158.24	21.06	30.58	267
180	0.54846	3636.7	5095.3	159.10	21.03	30.47	271
185	0.53233	3744.6	5247.5	159.93	21.01	30.37	275
190	0.51718	3852.3	5399.1	160.74	21.00	30.28	279
195	0.50293	3959.6	5550.3	161.53	20.98	30.20	283
200	0.48948	4066.7	5701.1	162.29	20.97	30.13	287
210	0.46474	4280.4	6001.8	163.76	20.94	30.01	295
220	0.44248	4493.3	6301.3	165.15	20.93	29.90	302
230	0.42234	4705.7	6599.9	166.48	20.91	29.82	309
240	0.40402	4917.6	6897.7	167.74	20.90	29.74	316
250	0.38728	5129.1	7194.8	168.96	20.89	29.68	323
260	0.37190	5340.3	7491.4	170.12	20.88	29.63	329
270	0.35773	5551.1	7787.4	171.24	20.87	29.59	336
280	0.34463	5761.8	8083.1	172.31	20.87	29.55	342
290	0.33248	5972.3	8378.4	173.35	20.87	29.52	348
300	0.32117	6182.5	8673.5	174.35	20.87	29.49	354

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
310	0.31062	6392.7	8968.2	175.32	20.87	29.47	360
320	0.30075	6602.8	9262.8	176.25	20.87	29.45	366
330	0.29150	6812.8	9557.2	177.16	20.87	29.43	372
340	0.28281	7022.8	9851.5	178.04	20.88	29.42	377
350	0.27464	7232.7	10146.	178.89	20.89	29.42	383
360	0.26692	7442.7	10440.	179.72	20.90	29.41	388
370	0.25964	7652.8	10734.	180.52	20.91	29.41	394
380	0.25275	7862.9	11028.	181.31	20.93	29.42	399
390	0.24621	8073.1	11322.	182.07	20.94	29.42	404
400	0.24001	8283.4	11617.	182.82	20.96	29.43	409
420	0.22851	8704.6	12205.	184.25	21.01	29.46	419
440	0.21808	9126.6	12795.	185.62	21.06	29.50	429
460	0.20856	9549.7	13386.	186.94	21.13	29.55	438
480	0.19984	9974.0	13977.	188.20	21.20	29.62	447
500	0.19183	10400.	14570.	189.41	21.29	29.69	456
520	0.18443	10827.	15165.	190.57	21.38	29.77	465
540	0.17759	11257.	15761.	191.70	21.47	29.86	474
560	0.17125	11688.	16360.	192.79	21.58	29.96	482
580	0.16534	12121.	16960.	193.84	21.69	30.07	490
600	0.15983	12557.	17562.	194.86	21.81	30.18	498
620	0.15467	12995.	18167.	195.85	21.93	30.30	506
640	0.14984	13435.	18774.	196.82	22.06	30.42	514
660	0.14530	13878.	19384.	197.75	22.19	30.55	521
680	0.14103	14324.	19996.	198.67	22.32	30.68	528
700	0.13700	14772.	20611.	199.56	22.45	30.81	536
720	0.13320	15223.	21228.	200.43	22.59	30.94	543
740	0.12961	15676.	21849.	201.28	22.72	31.07	550
760	0.12620	16132.	22471.	202.11	22.86	31.20	557
780	0.12297	16591.	23097.	202.92	22.99	31.34	563
800	0.11990	17052.	23725.	203.72	23.13	31.47	570
850	0.11286	18218.	25307.	205.63	23.46	31.80	587
900	0.10660	19400.	26905.	207.46	23.79	32.12	602
950	0.10100	20597.	28518.	209.21	24.10	32.43	618
1000	0.09596	21810.	30147.	210.88	24.39	32.72	633
1050	0.09139	23037.	31790.	212.48	24.67	33.00	647
1100	0.08725	24277.	33446.	214.02	24.93	33.26	662
1150	0.08346	25530.	35116.	215.50	25.18	33.51	676
1200	0.07999	26796.	36797.	216.94	25.42	33.74	689
1250	0.07680	28072.	38489.	218.32	25.63	33.96	703
1300	0.07385	29359.	40192.	219.65	25.84	34.16	716
1350	0.07112	30656.	41905.	220.95	26.03	34.35	729
1400	0.06858	31962.	43627.	222.20	26.21	34.53	741
1450	0.06622	33277.	45357.	223.41	26.38	34.69	754
1500	0.06402	34600.	47096.	224.59	26.53	34.85	766
1550	0.06196	35930.	48842.	225.74	26.68	35.00	778

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1600	0.06002	37268.	50596.	226.85	26.82	35.14	790
1650	0.05821	38612.	52356.	227.93	26.95	35.26	802
1700	0.05650	39963.	54122.	228.99	27.07	35.39	814
1750	0.05489	41319.	55894.	230.02	27.18	35.50	825
1800	0.05337	42681.	57672.	231.02	27.29	35.61	836
1850	0.05193	44048.	59455.	231.99	27.39	35.71	847
1900	0.05056	45420.	61243.	232.95	27.49	35.80	858
1950	0.04927	46797.	63035.	233.88	27.58	35.89	869
2000	0.04804	48178.	64832.	234.79	27.66	35.98	880
			1.00 MPa Isobar				
* 63.35	31.076	-4226.4	-4194.2	67.91	31.35	56.43	1026
64	30.977	-4189.9	-4157.6	68.49	31.28	56.37	1017
66	30.670	-4077.6	-4045.0	70.22	31.09	56.26	991
68	30.362	-3965.4	-3932.5	71.90	30.90	56.23	966
70	30.051	-3853.3	-3820.0	73.53	30.70	56.28	941
72	29.737	-3741.0	-3707.4	75.11	30.49	56.39	918
74	29.420	-3628.4	-3594.4	76.66	30.29	56.55	895
76	29.098	-3515.5	-3481.1	78.17	30.08	56.77	873
78	28.771	-3402.1	-3367.3	79.65	29.87	57.03	851
80	28.439	-3288.1	-3252.9	81.10	29.66	57.35	830
82	28.101	-3173.5	-3137.9	82.52	29.45	57.71	808
84	27.756	-3058.1	-3022.1	83.91	29.24	58.12	787
86	27.404	-2941.9	-2905.4	85.29	29.04	58.59	766
88	27.043	-2824.6	-2787.7	86.64	28.83	59.13	744
90	26.674	-2706.3	-2668.8	87.98	28.64	59.75	722
92	26.294	-2586.6	-2548.6	89.30	28.45	60.45	700
94	25.902	-2465.5	-2426.9	90.61	28.27	61.27	678
96	25.496	-2342.7	-2303.4	91.90	28.11	62.23	654
98	25.075	-2217.8	-2177.9	93.20	27.95	63.36	631
100	24.635	-2090.4	-2049.8	94.49	27.82	64.73	606
102	24.173	-1960.1	-1918.8	95.79	27.71	66.39	580
* 103.73	23.750	-1844.2	-1802.1	96.92	27.65	68.18	556
* 103.73	1.4774	1774.8	2451.7	137.93	27.72	51.32	180
104	1.4691	1784.5	2465.2	138.06	27.38	50.49	181
106	1.4117	1852.7	2561.1	138.98	25.43	45.75	186
108	1.3617	1915.0	2649.4	139.80	24.25	42.75	190
110	1.3171	1973.5	2732.7	140.57	23.50	40.71	194
112	1.2769	2029.4	2812.6	141.29	23.01	39.25	197
114	1.2400	2083.5	2889.9	141.97	22.68	38.15	201
116	1.2061	2136.2	2965.3	142.63	22.44	37.28	204
118	1.1746	2187.8	3039.2	143.26	22.26	36.58	206

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
120	1.1453	2238.6	3111.7	143.87	22.12	35.99	209
122	1.1178	2288.6	3183.2	144.46	22.01	35.49	212
124	1.0920	2338.0	3253.7	145.03	21.92	35.06	214
126	1.0676	2386.8	3323.5	145.59	21.84	34.68	217
128	1.0446	2435.2	3392.5	146.13	21.77	34.34	219
130	1.0228	2483.1	3460.8	146.66	21.71	34.03	222
132	1.0021	2530.7	3528.6	147.18	21.66	33.76	224
134	0.98236	2577.9	3595.9	147.69	21.61	33.51	226
136	0.96356	2624.9	3662.7	148.18	21.57	33.28	229
138	0.94561	2671.5	3729.0	148.67	21.53	33.07	231
140	0.92843	2717.9	3795.0	149.14	21.49	32.88	233
142	0.91198	2764.1	3860.6	149.60	21.46	32.70	235
144	0.89620	2810.0	3925.8	150.06	21.42	32.54	237
146	0.88105	2855.7	3990.7	150.51	21.40	32.39	239
148	0.86647	2901.3	4055.4	150.95	21.37	32.24	241
150	0.85245	2946.6	4119.7	151.38	21.34	32.11	243
155	0.81957	3059.3	4279.5	152.43	21.28	31.81	248
160	0.78944	3171.2	4437.9	153.43	21.24	31.56	253
165	0.76170	3282.3	4595.2	154.40	21.19	31.34	257
170	0.73604	3392.8	4751.4	155.33	21.16	31.15	262
175	0.71223	3502.7	4906.7	156.24	21.12	30.99	266
180	0.69005	3612.1	5061.3	157.11	21.10	30.84	271
185	0.66932	3721.1	5215.2	157.95	21.07	30.71	275
190	0.64990	3829.7	5368.4	158.77	21.05	30.59	279
195	0.63166	3938.0	5521.1	159.56	21.03	30.49	283
200	0.61448	4045.9	5673.3	160.33	21.01	30.40	287
210	0.58295	4261.1	5976.5	161.81	20.98	30.24	295
220	0.55468	4475.3	6278.2	163.21	20.96	30.11	302
230	0.52915	4688.9	6578.7	164.55	20.94	30.00	309
240	0.50597	4901.8	6878.2	165.82	20.92	29.91	316
250	0.48481	5114.2	7176.9	167.04	20.91	29.83	323
260	0.46542	5326.2	7474.8	168.21	20.90	29.76	330
270	0.44757	5537.8	7772.1	169.33	20.89	29.70	336
280	0.43107	5749.1	8068.9	170.41	20.89	29.66	342
290	0.41579	5960.2	8365.3	171.45	20.88	29.62	349
300	0.40158	6171.1	8661.2	172.46	20.88	29.58	355
310	0.38833	6381.7	8956.9	173.43	20.88	29.55	361
320	0.37594	6592.3	9252.3	174.36	20.88	29.53	366
330	0.36434	6802.7	9547.4	175.27	20.89	29.51	372
340	0.35345	7013.1	9842.4	176.15	20.89	29.49	378
350	0.34320	7223.5	10137.	177.01	20.90	29.48	383
360	0.33353	7433.8	10432.	177.84	20.91	29.47	389
370	0.32441	7644.2	10727.	178.64	20.92	29.47	394
380	0.31578	7854.6	11021.	179.43	20.94	29.47	399
390	0.30760	8065.1	11316.	180.20	20.95	29.47	405

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
400	0.29984	8275.7	11611.	180.94	20.97	29.48	410
420	0.28546	8697.4	12201.	182.38	21.02	29.50	420
440	0.27240	9119.9	12791.	183.75	21.07	29.54	429
460	0.26050	9543.4	13382.	185.07	21.13	29.59	439
480	0.24960	9968.1	13974.	186.33	21.21	29.65	448
500	0.23959	10394.	14568.	187.54	21.29	29.72	457
520	0.23035	10822.	15163.	188.71	21.38	29.80	466
540	0.22181	11252.	15760.	189.83	21.48	29.89	474
560	0.21388	11683.	16359.	190.92	21.58	29.98	483
580	0.20650	12117.	16959.	191.98	21.70	30.09	491
600	0.19961	12553.	17562.	193.00	21.81	30.20	499
620	0.19317	12991.	18167.	193.99	21.94	30.32	506
640	0.18714	13431.	18775.	194.95	22.06	30.44	514
660	0.18147	13874.	19385.	195.89	22.19	30.56	522
680	0.17614	14320.	19997.	196.81	22.32	30.69	529
700	0.17111	14768.	20612.	197.70	22.46	30.82	536
720	0.16637	15219.	21230.	198.57	22.59	30.95	543
740	0.16188	15673.	21850.	199.42	22.73	31.08	550
760	0.15762	16129.	22473.	200.25	22.86	31.21	557
780	0.15359	16588.	23099.	201.06	23.00	31.35	564
800	0.14976	17050.	23727.	201.86	23.13	31.48	571
850	0.14096	18215.	25310.	203.78	23.46	31.81	587
900	0.13315	19398.	26908.	205.60	23.79	32.13	603
950	0.12616	20595.	28522.	207.35	24.10	32.43	618
1000	0.11986	21808.	30151.	209.02	24.39	32.72	633
1050	0.11417	23035.	31794.	210.62	24.67	33.00	648
1100	0.10899	24276.	33451.	212.16	24.94	33.26	662
1150	0.10426	25529.	35120.	213.65	25.18	33.51	676
1200	0.09993	26794.	36802.	215.08	25.42	33.74	690
1250	0.09594	28071.	38494.	216.46	25.64	33.96	703
1300	0.09226	29358.	40197.	217.80	25.84	34.16	716
1350	0.08885	30655.	41910.	219.09	26.03	34.35	729
1400	0.08568	31961.	43632.	220.34	26.21	34.53	742
1450	0.08274	33276.	45363.	221.56	26.38	34.70	754
1500	0.07998	34599.	47102.	222.74	26.53	34.85	767
1550	0.07741	35930.	48848.	223.88	26.68	35.00	779
1600	0.07500	37268.	50602.	224.99	26.82	35.14	791
1650	0.07273	38612.	52362.	226.08	26.95	35.27	802
1700	0.07059	39962.	54128.	227.13	27.07	35.39	814
1750	0.06858	41319.	55900.	228.16	27.19	35.50	825
1800	0.06668	42681.	57678.	229.16	27.29	35.61	837
1850	0.06488	44048.	59461.	230.14	27.39	35.71	848
1900	0.06318	45420.	61249.	231.09	27.49	35.80	859
1950	0.06156	46797.	63041.	232.02	27.58	35.89	870
2000	0.06002	48178.	64838.	232.93	27.67	35.98	880

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
			1.50 MPa Isobar				
* 63.46	31.090	-4225.2	-4177.0	67.93	31.37	56.37	1029
64	31.008	-4194.9	-4146.5	68.41	31.32	56.31	1021
66	30.703	-4082.9	-4034.1	70.14	31.13	56.19	995
68	30.397	-3971.1	-3921.7	71.81	30.93	56.15	970
70	30.088	-3859.3	-3809.4	73.44	30.73	56.19	946
72	29.776	-3747.3	-3696.9	75.03	30.52	56.28	922
74	29.461	-3635.2	-3584.2	76.57	30.32	56.43	900
76	29.142	-3522.6	-3471.2	78.08	30.11	56.64	878
78	28.818	-3409.7	-3357.7	79.55	29.89	56.88	856
80	28.489	-3296.3	-3243.6	81.00	29.68	57.18	835
82	28.154	-3182.2	-3128.9	82.41	29.47	57.52	814
84	27.813	-3067.4	-3013.5	83.80	29.26	57.91	792
86	27.465	-2951.9	-2897.3	85.17	29.05	58.35	771
88	27.109	-2835.4	-2780.1	86.52	28.85	58.85	750
90	26.744	-2717.9	-2661.8	87.85	28.65	59.42	729
92	26.370	-2599.2	-2542.3	89.16	28.45	60.08	707
94	25.985	-2479.1	-2421.4	90.46	28.27	60.83	685
96	25.587	-2357.5	-2298.9	91.75	28.09	61.71	663
98	25.175	-2234.1	-2174.5	93.03	27.93	62.74	640
100	24.746	-2108.4	-2047.8	94.31	27.78	63.97	616
102	24.297	-1980.2	-1918.4	95.59	27.66	65.45	591
104	23.824	-1848.7	-1785.8	96.88	27.56	67.27	565
106	23.321	-1713.4	-1649.0	98.18	27.49	69.58	537
108	22.779	-1572.9	-1507.0	99.51	27.47	72.59	507
110	22.187	-1425.6	-1357.9	100.88	27.53	76.71	474
* 110.38	22.066	-1396.4	-1328.4	101.14	27.55	77.67	467
* 110.38	2.2948	1741.9	2395.6	134.88	28.64	63.44	178
112	2.1999	1810.4	2492.2	135.75	26.78	56.56	183
114	2.1017	1885.8	2599.5	136.70	25.32	51.13	188
116	2.0180	1954.6	2697.9	137.56	24.40	47.55	193
118	1.9448	2019.1	2790.4	138.35	23.78	45.02	197
120	1.8796	2080.4	2878.4	139.09	23.36	43.13	201
122	1.8208	2139.4	2963.2	139.79	23.04	41.65	204
124	1.7672	2196.5	3045.2	140.46	22.81	40.47	207
126	1.7181	2252.1	3125.2	141.09	22.62	39.49	210
128	1.6726	2306.5	3203.3	141.71	22.46	38.66	213
130	1.6304	2359.9	3279.9	142.30	22.34	37.95	216
132	1.5910	2412.4	3355.2	142.88	22.23	37.34	219
134	1.5540	2464.1	3429.3	143.44	22.13	36.80	221
136	1.5193	2515.1	3502.4	143.98	22.05	36.31	224

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
138	1.4865	2565.5	3574.6	144.50	21.98	35.88	226
140	1.4556	2615.4	3646.0	145.02	21.91	35.50	229
142	1.4262	2664.8	3716.6	145.52	21.85	35.15	231
144	1.3983	2713.8	3786.6	146.01	21.79	34.83	233
146	1.3717	2762.4	3855.9	146.49	21.74	34.54	236
148	1.3463	2810.6	3924.7	146.95	21.69	34.27	238
150	1.3221	2858.5	3993.0	147.41	21.65	34.02	240
155	1.2660	2976.9	4161.7	148.52	21.55	33.48	245
160	1.2153	3093.7	4328.0	149.58	21.47	33.03	251
165	1.1691	3209.2	4492.2	150.59	21.41	32.65	256
170	1.1269	3323.6	4654.6	151.56	21.35	32.33	260
175	1.0881	3437.0	4815.6	152.49	21.30	32.05	265
180	1.0521	3549.5	4975.2	153.39	21.25	31.81	269
185	1.0188	3661.4	5133.7	154.26	21.21	31.59	274
190	0.98779	3772.6	5291.2	155.10	21.18	31.40	278
195	0.95879	3883.3	5447.8	155.91	21.15	31.24	282
200	0.93161	3993.5	5603.6	156.70	21.12	31.09	286
210	0.88203	4212.5	5913.1	158.21	21.08	30.83	294
220	0.83787	4430.2	6220.4	159.64	21.04	30.63	302
230	0.79823	4646.7	6525.8	161.00	21.01	30.46	309
240	0.76240	4862.2	6829.7	162.29	20.99	30.31	316
250	0.72984	5076.9	7132.2	163.52	20.97	30.19	323
260	0.70009	5291.0	7433.6	164.71	20.95	30.09	330
270	0.67278	5504.5	7734.0	165.84	20.94	30.00	337
280	0.64762	5717.5	8033.7	166.93	20.93	29.93	343
290	0.62434	5930.1	8332.6	167.98	20.92	29.86	349
300	0.60275	6142.4	8631.0	168.99	20.91	29.81	356
310	0.58265	6354.3	8928.8	169.97	20.91	29.76	362
320	0.56389	6566.1	9226.2	170.91	20.91	29.72	367
330	0.54633	6777.6	9523.2	171.83	20.91	29.69	373
340	0.52987	6989.0	9819.9	172.71	20.92	29.66	379
350	0.51440	7200.3	10116.	173.57	20.92	29.63	384
360	0.49982	7411.6	10413.	174.41	20.93	29.62	390
370	0.48607	7622.8	10709.	175.22	20.94	29.60	395
380	0.47307	7834.0	11005.	176.01	20.96	29.60	401
390	0.46077	8045.2	11301.	176.77	20.97	29.59	406
400	0.44909	8256.5	11597.	177.52	20.99	29.59	411
420	0.42747	8679.4	12188.	178.97	21.03	29.60	421
440	0.40787	9103.0	12781.	180.35	21.09	29.63	431
460	0.39000	9527.6	13374.	181.66	21.15	29.67	440
480	0.37366	9953.2	13968.	182.93	21.22	29.72	449
500	0.35865	10380.	14563.	184.14	21.30	29.78	458
520	0.34481	10809.	15159.	185.31	21.39	29.86	467
540	0.33201	11239.	15757.	186.44	21.49	29.94	476
560	0.32013	11671.	16357.	187.53	21.59	30.04	484

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
580	0.30909	12105.	16958.	188.59	21.71	30.14	492
600	0.29878	12542.	17562.	189.61	21.82	30.24	500
620	0.28914	12980.	18168.	190.60	21.94	30.36	508
640	0.28012	13422.	18777.	191.57	22.07	30.47	515
660	0.27164	13865.	19387.	192.51	22.20	30.60	523
680	0.26366	14311.	20000.	193.42	22.33	30.72	530
700	0.25614	14760.	20616.	194.32	22.46	30.85	537
720	0.24904	15211.	21234.	195.19	22.60	30.98	545
740	0.24232	15665.	21855.	196.04	22.73	31.11	552
760	0.23596	16122.	22479.	196.87	22.87	31.24	558
780	0.22993	16581.	23105.	197.68	23.00	31.37	565
800	0.22419	17043.	23734.	198.48	23.14	31.50	572
850	0.21104	18209.	25317.	200.40	23.47	31.83	588
900	0.19936	19392.	26916.	202.23	23.79	32.14	604
950	0.18890	20590.	28531.	203.97	24.10	32.45	619
1000	0.17949	21804.	30161.	205.64	24.40	32.74	634
1050	0.17097	23031.	31805.	207.25	24.68	33.01	649
1100	0.16322	24272.	33462.	208.79	24.94	33.27	663
1150	0.15615	25526.	35132.	210.27	25.19	33.52	677
1200	0.14967	26791.	36814.	211.71	25.42	33.75	691
1250	0.14370	28068.	38507.	213.09	25.64	33.97	704
1300	0.13820	29356.	40210.	214.42	25.84	34.17	717
1350	0.13309	30653.	41923.	215.72	26.03	34.36	730
1400	0.12836	31959.	43646.	216.97	26.21	34.54	743
1450	0.12395	33275.	45377.	218.18	26.38	34.70	755
1500	0.11983	34598.	47116.	219.36	26.54	34.86	768
1550	0.11598	35928.	48862.	220.51	26.68	35.00	780
1600	0.11236	37266.	50616.	221.62	26.82	35.14	792
1650	0.10897	38611.	52376.	222.71	26.95	35.27	803
1700	0.10577	39962.	54143.	223.76	27.07	35.39	815
1750	0.10276	41318.	55915.	224.79	27.19	35.50	826
1800	0.09991	42680.	57693.	225.79	27.29	35.61	837
1850	0.09722	44048.	59476.	226.77	27.40	35.71	849
1900	0.09467	45420.	61264.	227.72	27.49	35.81	860
1950	0.09225	46797.	63057.	228.65	27.58	35.90	870
2000	0.08995	48178.	64854.	229.56	27.67	35.98	881
			2.00 MPa Isobar				
* 63.57	31.103	-4224.0	-4159.7	67.95	31.40	56.30	1031
64	31.038	-4199.9	-4135.5	68.33	31.36	56.26	1025
66	30.735	-4088.2	-4023.1	70.06	31.17	56.12	999
68	30.431	-3976.6	-3910.9	71.73	30.97	56.07	973

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
70	30.124	-3865.2	-3798.8	73.36	30.76	56.10	950
72	29.815	-3753.6	-3686.5	74.94	30.56	56.18	926
74	29.502	-3641.8	-3574.0	76.48	30.35	56.32	904
76	29.185	-3529.7	-3461.2	77.98	30.13	56.51	882
78	28.864	-3417.2	-3347.9	79.45	29.92	56.74	861
80	28.538	-3304.3	-3234.2	80.89	29.71	57.01	840
82	28.206	-3190.8	-3119.9	82.31	29.49	57.33	819
84	27.869	-3076.6	-3004.8	83.69	29.28	57.70	798
86	27.524	-2961.7	-2889.0	85.05	29.07	58.11	777
88	27.173	-2845.9	-2772.3	86.40	28.86	58.59	756
90	26.813	-2729.2	-2654.6	87.72	28.66	59.12	735
92	26.444	-2611.4	-2535.8	89.02	28.46	59.73	714
94	26.065	-2492.4	-2415.7	90.32	28.27	60.43	693
96	25.675	-2371.9	-2294.0	91.60	28.09	61.23	671
98	25.271	-2249.8	-2170.6	92.87	27.92	62.17	648
100	24.852	-2125.7	-2045.2	94.13	27.76	63.28	625
102	24.415	-1999.3	-1917.4	95.40	27.62	64.60	601
104	23.957	-1870.1	-1786.7	96.67	27.50	66.20	576
106	23.472	-1737.5	-1652.3	97.95	27.40	68.19	550
108	22.956	-1600.6	-1513.5	99.25	27.34	70.73	522
110	22.397	-1458.2	-1368.9	100.57	27.34	74.06	492
112	21.782	-1308.3	-1216.4	101.95	27.41	78.67	459
114	21.085	-1147.6	-1052.8	103.39	27.62	85.50	421
* 115.58	20.447	-1009.2	-911.34	104.63	27.94	93.93	388
* 115.58	3.2451	1660.1	2276.5	132.21	29.93	84.47	175
116	3.1937	1684.6	2310.8	132.50	29.25	80.10	177
118	2.9909	1787.0	2455.7	133.74	26.98	66.32	184
120	2.8336	1874.2	2580.0	134.79	25.62	58.56	190
122	2.7042	1952.2	2691.8	135.71	24.75	53.56	195
124	2.5940	2024.2	2795.2	136.55	24.15	50.05	199
126	2.4978	2091.9	2892.6	137.33	23.72	47.45	203
128	2.4124	2156.3	2985.4	138.06	23.40	45.43	206
130	2.3357	2218.3	3074.6	138.75	23.14	43.82	210
132	2.2659	2278.2	3160.8	139.41	22.94	42.49	213
134	2.2021	2336.4	3244.6	140.04	22.77	41.37	216
136	2.1433	2393.3	3326.4	140.65	22.62	40.42	219
138	2.0888	2448.9	3406.4	141.23	22.50	39.60	222
140	2.0380	2503.5	3484.9	141.80	22.38	38.88	225
142	1.9905	2557.2	3562.0	142.34	22.29	38.24	227
144	1.9460	2610.1	3637.9	142.88	22.20	37.68	230
146	1.9040	2662.3	3712.7	143.39	22.12	37.17	232
148	1.8643	2713.9	3786.6	143.89	22.05	36.72	235
150	1.8268	2764.8	3859.6	144.38	21.98	36.31	237
155	1.7410	2890.1	4038.9	145.56	21.84	35.42	243
160	1.6647	3012.8	4214.2	146.67	21.72	34.71	248

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
165	1.5963	3133.3	4386.2	147.73	21.62	34.12	254
170	1.5344	3252.1	4555.6	148.74	21.54	33.63	259
175	1.4780	3369.4	4722.6	149.71	21.47	33.21	264
180	1.4262	3485.5	4887.7	150.64	21.41	32.85	268
185	1.3786	3600.4	5051.2	151.54	21.35	32.54	273
190	1.3345	3714.5	5213.2	152.40	21.31	32.26	277
195	1.2935	3827.7	5373.9	153.24	21.27	32.02	282
200	1.2553	3940.3	5533.4	154.04	21.23	31.81	286
210	1.1861	4163.5	5849.7	155.59	21.17	31.45	294
220	1.1248	4384.7	6162.7	157.04	21.12	31.16	302
230	1.0701	4604.2	6473.1	158.42	21.08	30.93	310
240	1.0210	4822.5	6781.4	159.74	21.05	30.73	317
250	0.97645	5039.6	7087.8	160.99	21.02	30.56	324
260	0.93591	5255.8	7392.7	162.18	21.00	30.42	331
270	0.89881	5471.1	7696.3	163.33	20.98	30.30	337
280	0.86471	5685.9	7998.8	164.43	20.97	30.20	344
290	0.83323	5900.0	8300.3	165.49	20.96	30.11	350
300	0.80408	6113.7	8601.1	166.51	20.95	30.03	356
310	0.77698	6327.0	8901.1	167.49	20.94	29.97	363
320	0.75173	6540.0	9200.5	168.44	20.94	29.91	368
330	0.72814	6752.6	9499.4	169.36	20.94	29.86	374
340	0.70603	6965.1	9797.8	170.25	20.94	29.82	380
350	0.68527	7177.3	10096.	171.11	20.95	29.79	386
360	0.66574	7389.4	10394.	171.95	20.95	29.76	391
370	0.64733	7601.4	10691.	172.77	20.96	29.74	397
380	0.62993	7813.4	10988.	173.56	20.98	29.72	402
390	0.61347	8025.4	11286.	174.33	20.99	29.71	407
400	0.59787	8237.4	11583.	175.09	21.01	29.70	412
420	0.56898	8661.6	12177.	176.53	21.05	29.70	422
440	0.54282	9086.3	12771.	177.92	21.10	29.72	432
460	0.51900	9511.8	13365.	179.24	21.16	29.75	441
480	0.49722	9938.4	13961.	180.50	21.23	29.79	451
500	0.47721	10366.	14557.	181.72	21.31	29.85	460
520	0.45878	10796.	15155.	182.89	21.40	29.92	468
540	0.44174	11227.	15754.	184.02	21.50	30.00	477
560	0.42593	11659.	16355.	185.12	21.60	30.09	485
580	0.41123	12094.	16958.	186.17	21.72	30.18	493
600	0.39752	12531.	17562.	187.20	21.83	30.29	501
620	0.38470	12970.	18169.	188.19	21.95	30.40	509
640	0.37269	13412.	18778.	189.16	22.08	30.51	517
660	0.36142	13856.	19390.	190.10	22.21	30.63	524
680	0.35081	14302.	20004.	191.02	22.34	30.75	532
700	0.34081	14751.	20620.	191.91	22.47	30.88	539
720	0.33137	15203.	21239.	192.78	22.60	31.01	546
740	0.32244	15657.	21860.	193.63	22.74	31.14	553

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
760	0.31398	16114.	22484.	194.47	22.87	31.27	560
780	0.30596	16574.	23111.	195.28	23.01	31.40	567
800	0.29834	17036.	23740.	196.08	23.14	31.53	573
850	0.28086	18203.	25324.	198.00	23.48	31.85	589
900	0.26532	19387.	26925.	199.83	23.80	32.16	605
950	0.25142	20585.	28540.	201.57	24.11	32.46	621
1000	0.23890	21799.	30171.	203.25	24.40	32.75	636
1050	0.22758	23027.	31815.	204.85	24.68	33.03	650
1100	0.21728	24268.	33473.	206.39	24.94	33.28	664
1150	0.20788	25522.	35143.	207.88	25.19	33.53	678
1200	0.19926	26788.	36826.	209.31	25.42	33.76	692
1250	0.19133	28066.	38519.	210.69	25.64	33.97	705
1300	0.18400	29353.	40223.	212.03	25.85	34.18	718
1350	0.17722	30651.	41936.	213.32	26.04	34.36	731
1400	0.17092	31958.	43659.	214.58	26.22	34.54	744
1450	0.16505	33273.	45390.	215.79	26.38	34.71	756
1500	0.15957	34596.	47130.	216.97	26.54	34.86	769
1550	0.15445	35927.	48876.	218.12	26.69	35.01	781
1600	0.14964	37265.	50630.	219.23	26.82	35.15	792
1650	0.14513	38610.	52391.	220.31	26.95	35.27	804
1700	0.14088	39961.	54157.	221.37	27.08	35.39	816
1750	0.13687	41317.	55930.	222.40	27.19	35.51	827
1800	0.13308	42680.	57708.	223.40	27.30	35.61	838
1850	0.12950	44047.	59491.	224.37	27.40	35.71	849
1900	0.12610	45419.	61280.	225.33	27.49	35.81	860
1950	0.12288	46796.	63072.	226.26	27.58	35.90	871
2000	0.11982	48178.	64869.	227.17	27.67	35.98	882
			2.50 MPa Isobar				
* 63.68	31.117	-4222.7	-4142.4	67.97	31.44	56.24	1033
64	31.069	-4204.8	-4124.4	68.25	31.40	56.20	1028
66	30.768	-4093.4	-4012.1	69.98	31.21	56.06	1002
68	30.465	-3982.1	-3900.1	71.65	31.00	56.00	977
70	30.160	-3871.0	-3788.1	73.27	30.80	56.01	953
72	29.853	-3759.7	-3676.0	74.85	30.59	56.08	930
74	29.542	-3648.3	-3563.7	76.39	30.38	56.21	908
76	29.228	-3536.7	-3451.1	77.89	30.16	56.38	886
78	28.909	-3424.6	-3338.2	79.36	29.95	56.60	865
80	28.586	-3312.2	-3224.7	80.79	29.73	56.86	844
82	28.258	-3199.2	-3110.7	82.20	29.52	57.16	824
84	27.923	-3085.6	-2996.1	83.58	29.30	57.50	803
86	27.583	-2971.3	-2880.7	84.94	29.09	57.89	783

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
88	27.235	-2856.2	-2764.5	86.28	28.88	58.33	762
90	26.880	-2740.3	-2647.3	87.59	28.67	58.83	741
92	26.517	-2623.4	-2529.1	88.89	28.47	59.40	721
94	26.144	-2505.3	-2409.7	90.18	28.28	60.04	700
96	25.760	-2385.9	-2288.8	91.45	28.09	60.78	678
98	25.364	-2265.0	-2166.4	92.71	27.91	61.64	656
100	24.954	-2142.4	-2042.2	93.96	27.74	62.65	634
102	24.528	-2017.7	-1915.7	95.22	27.59	63.83	611
104	24.083	-1890.5	-1786.7	96.47	27.45	65.25	587
106	23.615	-1760.4	-1654.5	97.73	27.34	66.99	562
108	23.119	-1626.6	-1518.5	99.00	27.25	69.15	535
110	22.588	-1488.2	-1377.5	100.29	27.20	71.92	507
112	22.012	-1343.8	-1230.2	101.62	27.21	75.59	477
114	21.373	-1191.2	-1074.2	103.00	27.30	80.70	444
116	20.646	-1026.8	-905.72	104.46	27.52	88.35	407
118	19.774	-843.81	-717.38	106.07	28.00	101.3	363
* 119.90	18.691	-637.39	-503.63	107.87	29.02	127.6	311
* 119.90	4.4290	1523.5	2087.9	129.49	31.72	129.4	171
120	4.4015	1532.6	2100.6	129.59	31.49	126.0	172
122	3.9878	1680.8	2307.8	131.30	28.25	88.03	181
124	3.7124	1792.8	2466.3	132.59	26.53	72.24	188
126	3.5030	1887.5	2601.1	133.67	25.47	63.36	194
128	3.3331	1971.7	2721.8	134.62	24.75	57.61	199
130	3.1899	2049.0	2832.7	135.48	24.24	53.56	203
132	3.0661	2121.3	2936.7	136.28	23.86	50.53	207
134	2.9570	2189.8	3035.3	137.02	23.56	48.17	211
136	2.8595	2255.4	3129.6	137.72	23.31	46.27	214
138	2.7715	2318.5	3220.6	138.38	23.11	44.71	217
140	2.6913	2379.7	3308.6	139.01	22.94	43.40	220
142	2.6176	2439.2	3394.3	139.62	22.79	42.28	223
144	2.5496	2497.3	3477.9	140.21	22.66	41.32	226
146	2.4865	2554.2	3559.6	140.77	22.54	40.47	229
148	2.4276	2610.0	3639.8	141.32	22.44	39.73	232
150	2.3724	2664.9	3718.6	141.84	22.34	39.07	234
155	2.2483	2798.5	3910.4	143.10	22.14	37.70	241
160	2.1403	2928.1	4096.1	144.28	21.98	36.63	246
165	2.0448	3054.4	4277.1	145.40	21.85	35.77	252
170	1.9595	3178.2	4454.1	146.45	21.74	35.06	257
175	1.8826	3299.9	4627.9	147.46	21.65	34.47	263
180	1.8128	3419.8	4798.9	148.42	21.57	33.97	267
185	1.7489	3538.2	4967.7	149.35	21.50	33.54	272
190	1.6902	3655.3	5134.4	150.24	21.44	33.17	277
195	1.6360	3771.3	5299.5	151.10	21.38	32.85	281
200	1.5857	3886.4	5463.0	151.92	21.34	32.56	286
210	1.4950	4113.9	5786.2	153.50	21.26	32.09	294

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
220	1.4154	4338.8	6105.1	154.98	21.20	31.71	302
230	1.3448	4561.6	6420.6	156.39	21.15	31.40	310
240	1.2815	4782.6	6733.3	157.72	21.11	31.15	317
250	1.2245	5002.1	7043.7	158.98	21.07	30.94	325
260	1.1728	5220.5	7352.2	160.19	21.05	30.76	331
270	1.1256	5437.8	7658.9	161.35	21.03	30.60	338
280	1.0823	5654.3	7964.3	162.46	21.01	30.47	345
290	1.0424	5870.0	8268.4	163.53	20.99	30.36	351
300	1.0055	6085.2	8571.5	164.56	20.98	30.26	357
310	0.97127	6299.8	8873.7	165.55	20.97	30.18	364
320	0.93943	6513.9	9175.1	166.51	20.97	30.10	370
330	0.90970	6727.7	9475.8	167.43	20.97	30.04	375
340	0.88189	6941.1	9776.0	168.33	20.97	29.99	381
350	0.85579	7154.4	10076.	169.20	20.97	29.94	387
360	0.83126	7367.4	10375.	170.04	20.98	29.90	392
370	0.80814	7580.2	10674.	170.86	20.98	29.87	398
380	0.78632	7793.0	10972.	171.65	20.99	29.85	403
390	0.76569	8005.7	11271.	172.43	21.01	29.83	408
400	0.74614	8218.3	11569.	173.18	21.02	29.81	414
420	0.70998	8643.8	12165.	174.64	21.06	29.80	424
440	0.67725	9069.7	12761.	176.02	21.11	29.81	433
460	0.64747	9496.2	13357.	177.35	21.18	29.83	443
480	0.62025	9923.7	13954.	178.62	21.25	29.87	452
500	0.59527	10352.	14552.	179.84	21.33	29.92	461
520	0.57226	10782.	15151.	181.01	21.41	29.98	470
540	0.55099	11214.	15751.	182.15	21.51	30.05	478
560	0.53127	11648.	16353.	183.24	21.61	30.14	487
580	0.51293	12083.	16957.	184.30	21.72	30.23	495
600	0.49583	12520.	17563.	185.33	21.84	30.33	503
620	0.47985	12960.	18170.	186.32	21.96	30.44	510
640	0.46487	13402.	18780.	187.29	22.09	30.55	518
660	0.45081	13847.	19392.	188.23	22.21	30.67	526
680	0.43759	14294.	20007.	189.15	22.34	30.79	533
700	0.42512	14743.	20624.	190.04	22.48	30.91	540
720	0.41336	15195.	21243.	190.92	22.61	31.04	547
740	0.40223	15650.	21865.	191.77	22.75	31.16	554
760	0.39169	16107.	22490.	192.60	22.88	31.29	561
780	0.38169	16567.	23117.	193.42	23.02	31.42	568
800	0.37219	17029.	23746.	194.21	23.15	31.55	574
850	0.35040	18197.	25332.	196.14	23.48	31.87	591
900	0.33104	19381.	26933.	197.97	23.80	32.18	606
950	0.31371	20580.	28549.	199.71	24.11	32.48	622
1000	0.29812	21795.	30181.	201.39	24.41	32.76	637
1050	0.28400	23023.	31826.	202.99	24.68	33.04	651
1100	0.27117	24265.	33484.	204.54	24.95	33.30	665

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1150	0.25945	25519.	35155.	206.02	25.20	33.54	679
1200	0.24870	26785.	36838.	207.45	25.43	33.77	693
1250	0.23881	28063.	38531.	208.84	25.65	33.98	706
1300	0.22968	29351.	40236.	210.17	25.85	34.18	719
1350	0.22122	30649.	41949.	211.47	26.04	34.37	732
1400	0.21337	31956.	43672.	212.72	26.22	34.55	745
1450	0.20605	33271.	45404.	213.93	26.39	34.71	757
1500	0.19922	34595.	47144.	215.11	26.54	34.87	769
1550	0.19283	35926.	48891.	216.26	26.69	35.01	782
1600	0.18684	37264.	50645.	217.37	26.83	35.15	793
1650	0.18120	38609.	52405.	218.46	26.96	35.28	805
1700	0.17590	39960.	54172.	219.51	27.08	35.40	817
1750	0.17090	41317.	55945.	220.54	27.19	35.51	828
1800	0.16618	42679.	57723.	221.54	27.30	35.62	839
1850	0.16171	44047.	59507.	222.52	27.40	35.72	850
1900	0.15747	45419.	61295.	223.47	27.50	35.81	861
1950	0.15345	46796.	63088.	224.40	27.59	35.90	872
2000	0.14964	48178.	64885.	225.31	27.67	35.99	883
			3.00 MPa Isobar				
* 63.79	31.130	-4221.5	-4125.1	67.99	31.47	56.17	1035
64	31.099	-4209.7	-4113.2	68.17	31.45	56.15	1032
66	30.799	-4098.5	-4001.1	69.90	31.25	55.99	1006
68	30.499	-3987.6	-3889.2	71.57	31.04	55.92	981
70	30.196	-3876.7	-3777.4	73.19	30.84	55.92	957
72	29.890	-3765.8	-3665.5	74.76	30.63	55.99	934
74	29.582	-3654.8	-3553.4	76.30	30.41	56.10	912
76	29.270	-3543.5	-3441.0	77.80	30.20	56.26	891
78	28.954	-3431.9	-3328.3	79.26	29.98	56.46	870
80	28.634	-3319.9	-3215.2	80.69	29.76	56.71	849
82	28.308	-3207.5	-3101.5	82.10	29.54	56.99	828
84	27.977	-3094.4	-2987.2	83.48	29.33	57.31	808
86	27.640	-2980.7	-2872.2	84.83	29.11	57.68	788
88	27.297	-2866.3	-2756.4	86.16	28.90	58.09	768
90	26.946	-2751.1	-2639.8	87.47	28.69	58.56	747
92	26.588	-2635.0	-2522.2	88.76	28.49	59.08	727
94	26.220	-2517.8	-2403.4	90.04	28.29	59.68	706
96	25.843	-2399.5	-2283.4	91.30	28.10	60.37	685
98	25.454	-2279.8	-2161.9	92.55	27.91	61.15	664
100	25.053	-2158.4	-2038.7	93.80	27.74	62.07	642
102	24.637	-2035.3	-1913.5	95.04	27.58	63.14	620
104	24.203	-1910.0	-1786.0	96.28	27.43	64.40	597

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
106	23.750	-1782.1	-1655.7	97.52	27.30	65.93	573
108	23.272	-1651.0	-1522.1	98.77	27.19	67.80	548
110	22.765	-1516.0	-1384.2	100.03	27.11	70.14	521
112	22.219	-1376.1	-1241.1	101.32	27.07	73.15	493
114	21.625	-1229.7	-1091.0	102.65	27.08	77.14	463
116	20.964	-1074.5	-931.44	104.04	27.18	82.73	430
118	20.205	-906.70	-758.22	105.52	27.42	91.12	393
120	19.291	-718.74	-563.23	107.15	27.91	105.3	350
122	18.077	-492.64	-326.68	109.11	29.03	136.2	297
* 123.60	16.482	-234.58	-52.56	111.34	31.63	237.1	234
* 123.60	6.1411	1288.7	1777.2	126.14	34.59	290.1	166
124	5.8404	1361.7	1875.4	126.94	32.97	214.5	170
128	4.6116	1720.4	2370.9	130.88	27.01	86.45	189
130	4.3054	1832.3	2529.1	132.10	25.88	72.95	195
132	4.0675	1928.6	2666.2	133.15	25.12	64.77	200
134	3.8727	2015.2	2789.9	134.08	24.58	59.23	205
136	3.7076	2095.0	2904.1	134.93	24.17	55.20	209
138	3.5645	2169.7	3011.3	135.71	23.84	52.12	213
140	3.4383	2240.5	3113.0	136.44	23.58	49.69	216
142	3.3254	2308.2	3210.3	137.13	23.36	47.71	220
144	3.2234	2373.4	3304.1	137.79	23.17	46.07	223
146	3.1304	2436.4	3394.8	138.41	23.00	44.68	226
148	3.0451	2497.7	3482.9	139.01	22.86	43.49	229
150	2.9663	2557.5	3568.8	139.59	22.73	42.46	232
155	2.7926	2701.4	3775.7	140.95	22.47	40.39	238
160	2.6447	2839.3	3973.6	142.20	22.26	38.83	245
165	2.5164	2972.4	4164.6	143.38	22.09	37.62	251
170	2.4034	3101.9	4350.1	144.49	21.95	36.64	256
175	2.3027	3228.5	4531.3	145.54	21.83	35.84	262
180	2.2121	3352.6	4708.8	146.54	21.73	35.17	267
185	2.1300	3474.7	4883.2	147.49	21.64	34.61	272
190	2.0550	3595.1	5055.0	148.41	21.57	34.13	277
195	1.9861	3714.1	5224.6	149.29	21.50	33.71	281
200	1.9225	3831.8	5392.2	150.14	21.45	33.35	286
210	1.8087	4064.0	5722.6	151.75	21.35	32.75	294
220	1.7095	4292.7	6047.6	153.26	21.28	32.27	303
230	1.6220	4518.8	6368.4	154.69	21.22	31.89	310
240	1.5440	4742.6	6685.6	156.04	21.17	31.57	318
250	1.4739	4964.7	7000.0	157.32	21.13	31.31	325
260	1.4106	5185.2	7312.0	158.55	21.10	31.09	332
270	1.3529	5404.5	7622.0	159.72	21.07	30.90	339
280	1.3002	5622.8	7930.2	160.84	21.05	30.74	346
290	1.2517	5840.1	8236.9	161.91	21.03	30.61	352
300	1.2069	6056.7	8542.4	162.95	21.01	30.49	359

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
310	1.1654	6272.6	8846.7	163.95	21.00	30.38	365
320	1.1269	6488.0	9150.1	164.91	21.00	30.30	371
330	1.0910	6702.8	9452.7	165.84	20.99	30.22	377
340	1.0574	6917.3	9754.5	166.74	20.99	30.15	382
350	1.0259	7131.5	10056.	167.62	20.99	30.10	388
360	0.99633	7345.4	10356.	168.46	21.00	30.05	394
370	0.96848	7559.1	10657.	169.29	21.00	30.01	399
380	0.94222	7772.6	10957.	170.09	21.01	29.97	404
390	0.91739	7986.0	11256.	170.86	21.03	29.94	410
400	0.89389	8199.4	11556.	171.62	21.04	29.92	415
420	0.85044	8626.1	12154.	173.08	21.08	29.90	425
440	0.81114	9053.1	12752.	174.47	21.13	29.89	435
460	0.77541	9480.7	13350.	175.80	21.19	29.91	444
480	0.74276	9909.0	13948.	177.07	21.26	29.94	453
500	0.71282	10339.	14547.	178.30	21.34	29.98	462
520	0.68525	10769.	15147.	179.47	21.43	30.04	471
540	0.65976	11202.	15749.	180.61	21.52	30.11	480
560	0.63614	11636.	16352.	181.71	21.62	30.19	488
580	0.61418	12072.	16956.	182.77	21.73	30.28	496
600	0.59371	12510.	17563.	183.79	21.85	30.37	504
620	0.57457	12950.	18171.	184.79	21.97	30.48	512
640	0.55665	13393.	18782.	185.76	22.09	30.59	519
660	0.53983	13838.	19395.	186.70	22.22	30.70	527
680	0.52400	14285.	20010.	187.62	22.35	30.82	534
700	0.50908	14735.	20628.	188.52	22.48	30.94	541
720	0.49500	15187.	21248.	189.39	22.62	31.06	549
740	0.48169	15642.	21870.	190.24	22.75	31.19	555
760	0.46908	16100.	22495.	191.08	22.89	31.32	562
780	0.45711	16560.	23123.	191.89	23.02	31.44	569
800	0.44575	17023.	23753.	192.69	23.16	31.57	576
850	0.41968	18191.	25339.	194.61	23.49	31.89	592
900	0.39652	19376.	26941.	196.44	23.81	32.19	608
950	0.37579	20575.	28559.	198.19	24.12	32.49	623
1000	0.35713	21790.	30190.	199.87	24.41	32.78	638
1050	0.34024	23019.	31836.	201.47	24.69	33.05	652
1100	0.32488	24261.	33495.	203.02	24.95	33.31	667
1150	0.31086	25516.	35167.	204.50	25.20	33.55	680
1200	0.29800	26782.	36850.	205.93	25.43	33.78	694
1250	0.28616	28060.	38544.	207.32	25.65	33.99	707
1300	0.27523	29348.	40248.	208.65	25.85	34.19	720
1350	0.26511	30646.	41963.	209.95	26.04	34.38	733
1400	0.25570	31954.	43686.	211.20	26.22	34.55	746
1450	0.24695	33269.	45418.	212.42	26.39	34.72	758
1500	0.23877	34593.	47157.	213.60	26.55	34.87	770
1550	0.23112	35924.	48905.	214.74	26.69	35.02	782

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1600	0.22394	37263.	50659.	215.86	26.83	35.15	794
1650	0.21720	38608.	52420.	216.94	26.96	35.28	806
1700	0.21085	39959.	54187.	218.00	27.08	35.40	818
1750	0.20486	41316.	55960.	219.02	27.19	35.51	829
1800	0.19920	42678.	57738.	220.03	27.30	35.62	840
1850	0.19385	44046.	59522.	221.00	27.40	35.72	851
1900	0.18878	45419.	61310.	221.96	27.50	35.81	862
1950	0.18397	46796.	63103.	222.89	27.59	35.90	873
2000	0.17939	48177.	64900.	223.80	27.67	35.99	884
			4.00 MPa Isobar				
* 64.01	31.157	-4218.9	-4090.5	68.03	31.54	56.05	1038
66	30.862	-4108.6	-3979.0	69.74	31.33	55.87	1013
68	30.565	-3998.3	-3867.4	71.41	31.13	55.78	988
70	30.266	-3888.0	-3755.9	73.02	30.91	55.76	964
72	29.964	-3777.8	-3644.3	74.59	30.70	55.80	942
74	29.660	-3667.5	-3532.6	76.12	30.48	55.89	920
76	29.353	-3557.0	-3420.7	77.62	30.27	56.03	899
78	29.042	-3446.2	-3308.5	79.07	30.05	56.20	878
80	28.727	-3335.1	-3195.9	80.50	29.83	56.42	858
82	28.407	-3223.6	-3082.8	81.90	29.61	56.67	838
84	28.082	-3111.6	-2969.2	83.26	29.39	56.95	818
86	27.752	-2999.1	-2855.0	84.61	29.17	57.27	798
88	27.416	-2886.0	-2740.1	85.93	28.95	57.64	778
90	27.074	-2772.1	-2624.4	87.23	28.74	58.04	759
92	26.725	-2657.5	-2507.8	88.51	28.53	58.50	739
94	26.367	-2542.0	-2390.3	89.77	28.33	59.02	719
96	26.002	-2425.5	-2271.7	91.02	28.13	59.61	699
98	25.626	-2307.9	-2151.9	92.26	27.94	60.27	679
100	25.240	-2189.0	-2030.6	93.48	27.75	61.03	658
102	24.841	-2068.7	-1907.6	94.70	27.58	61.91	637
104	24.429	-1946.6	-1782.8	95.91	27.41	62.94	615
106	24.000	-1822.4	-1655.8	97.12	27.26	64.15	593
108	23.553	-1695.9	-1526.1	98.33	27.12	65.59	570
110	23.083	-1566.5	-1393.2	99.55	27.00	67.32	546
112	22.585	-1433.6	-1256.5	100.78	26.91	69.46	521
114	22.055	-1296.4	-1115.0	102.04	26.84	72.13	495
116	21.482	-1153.7	-967.49	103.32	26.81	75.57	467
118	20.854	-1003.8	-812.02	104.65	26.84	80.12	438
120	20.152	-844.34	-645.85	106.04	26.95	86.42	406
122	19.344	-671.22	-464.43	107.54	27.19	95.63	371
124	18.375	-477.41	-259.72	109.21	27.65	110.4	332

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
126	17.126	-247.92	-14.36	111.17	28.55	138.6	287
128	15.211	66.73	329.70	113.88	30.63	227.4	232
130	10.642	748.62	1124.5	120.03	34.16	491.7	179
132	7.8377	1252.8	1763.2	124.91	30.22	202.6	186
134	6.7814	1489.8	2079.7	127.29	27.99	127.8	194
136	6.1558	1652.5	2302.3	128.94	26.70	98.40	200
138	5.7138	1782.0	2482.0	130.26	25.84	82.68	205
140	5.3734	1892.5	2636.9	131.37	25.23	72.84	209
142	5.0972	1990.7	2775.4	132.35	24.76	66.07	213
144	4.8655	2080.2	2902.4	133.24	24.38	61.11	217
146	4.6662	2163.4	3020.6	134.06	24.08	57.31	221
148	4.4918	2241.6	3132.1	134.81	23.82	54.30	224
150	4.3369	2315.9	3238.2	135.53	23.60	51.85	228
155	4.0128	2488.6	3485.4	137.15	23.16	47.35	235
160	3.7525	2648.1	3714.0	138.60	22.83	44.26	242
165	3.5361	2798.2	3929.4	139.93	22.57	42.00	249
170	3.3517	2941.5	4134.9	141.15	22.36	40.29	255
175	3.1916	3079.6	4332.9	142.30	22.19	38.94	261
180	3.0505	3213.5	4524.7	143.38	22.05	37.85	266
185	2.9248	3344.0	4711.7	144.41	21.93	36.95	271
190	2.8116	3471.8	4894.5	145.38	21.83	36.20	276
195	2.7090	3597.2	5073.8	146.31	21.74	35.56	281
200	2.6153	3720.7	5250.2	147.21	21.66	35.01	286
210	2.4497	3962.8	5595.6	148.89	21.53	34.12	295
220	2.3075	4199.7	5933.2	150.46	21.43	33.43	304
230	2.1834	4432.7	6264.7	151.94	21.35	32.88	312
240	2.0739	4662.5	6591.2	153.33	21.28	32.44	320
250	1.9762	4889.7	6913.7	154.64	21.23	32.07	327
260	1.8885	5114.7	7232.8	155.89	21.19	31.77	334
270	1.8090	5338.0	7549.2	157.09	21.15	31.51	341
280	1.7367	5559.9	7863.1	158.23	21.12	31.29	348
290	1.6704	5780.4	8175.0	159.32	21.10	31.10	355
300	1.6095	5999.9	8485.2	160.38	21.08	30.94	361
310	1.5532	6218.5	8793.9	161.39	21.06	30.80	367
320	1.5010	6436.3	9101.2	162.36	21.05	30.67	373
330	1.4524	6653.4	9407.4	163.31	21.04	30.57	379
340	1.4071	6870.0	9712.6	164.22	21.04	30.48	385
350	1.3648	7086.1	10017.	165.10	21.04	30.40	391
360	1.3250	7301.8	10321.	165.95	21.04	30.33	396
370	1.2876	7517.1	10624.	166.78	21.04	30.27	402
380	1.2524	7732.2	10926.	167.59	21.05	30.22	407
390	1.2192	7947.1	11228.	168.38	21.06	30.18	412
400	1.1877	8161.8	11530.	169.14	21.08	30.14	418
420	1.1297	8591.0	12132.	170.61	21.11	30.09	428
440	1.0773	9020.2	12733.	172.01	21.16	30.07	438

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
460	1.0296	9449.8	13335.	173.34	21.22	30.06	447
480	0.98619	9880.0	13936.	174.62	21.28	30.08	456
500	0.94635	10311.	14538.	175.85	21.36	30.11	465
520	0.90970	10743.	15140.	177.03	21.45	30.16	474
540	0.87585	11177.	15744.	178.17	21.54	30.22	482
560	0.84448	11613.	16349.	179.27	21.64	30.29	491
580	0.81533	12050.	16956.	180.34	21.75	30.37	499
600	0.78816	12489.	17564.	181.37	21.87	30.46	507
620	0.76278	12930.	18174.	182.37	21.99	30.56	515
640	0.73901	13374.	18786.	183.34	22.11	30.66	522
660	0.71670	13819.	19401.	184.29	22.24	30.77	530
680	0.69571	14268.	20017.	185.21	22.37	30.88	537
700	0.67594	14718.	20636.	186.10	22.50	31.00	544
720	0.65727	15171.	21257.	186.98	22.63	31.12	551
740	0.63962	15627.	21881.	187.83	22.77	31.24	558
760	0.62291	16085.	22507.	188.67	22.90	31.36	565
780	0.60705	16546.	23135.	189.48	23.03	31.49	572
800	0.59199	17009.	23766.	190.28	23.17	31.61	578
850	0.55745	18179.	25355.	192.21	23.50	31.92	594
900	0.52675	19365.	26959.	194.04	23.82	32.23	610
950	0.49927	20566.	28577.	195.79	24.13	32.52	625
1000	0.47454	21781.	30210.	197.47	24.42	32.80	640
1050	0.45215	23011.	31857.	199.07	24.70	33.07	655
1100	0.43179	24254.	33517.	200.62	24.96	33.33	669
1150	0.41320	25509.	35190.	202.10	25.21	33.57	683
1200	0.39614	26777.	36874.	203.54	25.44	33.79	696
1250	0.38045	28055.	38569.	204.92	25.66	34.00	709
1300	0.36595	29344.	40274.	206.26	25.86	34.20	722
1350	0.35252	30642.	41989.	207.55	26.05	34.39	735
1400	0.34005	31950.	43713.	208.81	26.23	34.56	748
1450	0.32842	33266.	45445.	210.02	26.39	34.73	760
1500	0.31757	34590.	47185.	211.20	26.55	34.88	772
1550	0.30742	35922.	48933.	212.35	26.70	35.03	784
1600	0.29789	37260.	50688.	213.46	26.83	35.16	796
1650	0.28894	38606.	52449.	214.55	26.96	35.29	808
1700	0.28051	39957.	54217.	215.60	27.08	35.41	819
1750	0.27256	41314.	55990.	216.63	27.20	35.52	831
1800	0.26505	42677.	57768.	217.63	27.31	35.63	842
1850	0.25795	44045.	59552.	218.61	27.41	35.73	853
1900	0.25121	45418.	61341.	219.56	27.50	35.82	864
1950	0.24482	46795.	63134.	220.50	27.59	35.91	875
2000	0.23874	48177.	64932.	221.41	27.68	35.99	885

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
			5.00 MPa Isobar				
* 64.23	31.183	-4216.3	-4055.9	68.06	31.61	55.92	1042
66	30.923	-4118.6	-3956.9	69.59	31.43	55.75	1019
68	30.630	-4008.7	-3845.5	71.25	31.21	55.65	995
70	30.334	-3899.1	-3734.2	72.86	31.00	55.61	971
72	30.037	-3789.5	-3623.0	74.43	30.78	55.63	949
74	29.737	-3679.8	-3511.7	75.95	30.56	55.70	927
76	29.434	-3570.1	-3400.2	77.44	30.34	55.81	907
78	29.127	-3460.1	-3288.4	78.89	30.12	55.96	886
80	28.817	-3349.8	-3176.3	80.31	29.89	56.15	866
82	28.503	-3239.2	-3063.8	81.70	29.67	56.36	846
84	28.184	-3128.2	-2950.8	83.06	29.45	56.62	827
86	27.861	-3016.8	-2837.3	84.40	29.23	56.90	808
88	27.532	-2904.8	-2723.2	85.71	29.01	57.22	789
90	27.197	-2792.3	-2608.4	87.00	28.79	57.58	769
92	26.856	-2679.0	-2492.9	88.27	28.58	57.98	750
94	26.508	-2565.1	-2376.5	89.52	28.37	58.43	731
96	26.153	-2450.3	-2259.1	90.75	28.17	58.93	712
98	25.789	-2334.6	-2140.7	91.97	27.97	59.50	692
100	25.416	-2217.8	-2021.1	93.18	27.78	60.14	672
102	25.032	-2099.8	-1900.1	94.38	27.60	60.87	652
104	24.637	-1980.5	-1777.5	95.57	27.42	61.72	632
106	24.229	-1859.5	-1653.1	96.76	27.26	62.69	611
108	23.806	-1736.7	-1526.6	97.94	27.10	63.83	590
110	23.365	-1611.7	-1397.7	99.12	26.96	65.17	568
112	22.903	-1484.1	-1265.8	100.31	26.84	66.76	545
114	22.417	-1353.5	-1130.4	101.51	26.73	68.69	521
116	21.902	-1219.1	-990.77	102.72	26.64	71.04	497
118	21.351	-1080.1	-845.87	103.96	26.59	73.97	471
120	20.754	-935.30	-694.38	105.23	26.57	77.67	444
122	20.101	-783.21	-534.46	106.55	26.60	82.47	416
124	19.373	-621.58	-363.48	107.94	26.70	88.83	387
126	18.545	-447.21	-177.59	109.43	26.90	97.54	355
128	17.579	-255.21	29.22	111.06	27.24	110.1	323
130	16.411	-37.14	267.52	112.91	27.78	129.9	289
132	14.921	223.61	558.71	115.13	28.57	164.6	254
134	12.967	548.81	934.41	117.95	29.38	208.3	223
136	10.929	894.89	1352.4	121.05	29.20	199.0	210
138	9.4092	1178.3	1709.7	123.66	28.19	157.9	208
140	8.3792	1393.2	1990.0	125.67	27.19	124.6	210
142	7.6517	1562.5	2215.9	127.28	26.39	102.9	213

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
144	7.1056	1702.9	2406.5	128.61	25.77	88.61	216
146	6.6747	1824.2	2573.3	129.76	25.27	78.71	220
148	6.3218	1932.2	2723.1	130.78	24.87	71.51	223
150	6.0248	2030.6	2860.5	131.70	24.53	66.06	227
155	5.4442	2247.4	3165.8	133.71	23.89	56.91	234
160	5.0103	2437.3	3435.2	135.42	23.42	51.24	242
165	4.6672	2609.9	3681.2	136.93	23.07	47.39	248
170	4.3852	2770.7	3910.9	138.30	22.79	44.61	255
175	4.1472	2922.8	4128.4	139.56	22.56	42.50	261
180	3.9421	3068.3	4336.7	140.74	22.37	40.85	267
185	3.7625	3208.6	4537.5	141.84	22.21	39.53	272
190	3.6034	3344.8	4732.3	142.88	22.08	38.44	277
195	3.4608	3477.5	4922.2	143.86	21.97	37.54	282
200	3.3320	3607.4	5108.0	144.80	21.87	36.77	287
210	3.1074	3860.2	5469.3	146.57	21.70	35.55	296
220	2.9171	4105.9	5820.0	148.20	21.58	34.62	305
230	2.7529	4346.2	6162.4	149.72	21.48	33.90	314
240	2.6093	4582.1	6498.4	151.15	21.40	33.31	321
250	2.4822	4814.7	6829.0	152.50	21.33	32.84	329
260	2.3686	5044.4	7155.4	153.78	21.28	32.44	336
270	2.2663	5271.8	7478.1	155.00	21.23	32.11	344
280	2.1735	5497.3	7797.7	156.16	21.20	31.83	350
290	2.0888	5721.1	8114.8	157.27	21.17	31.59	357
300	2.0112	5943.6	8429.6	158.34	21.14	31.38	363
310	1.9397	6164.8	8742.5	159.37	21.12	31.20	370
320	1.8736	6385.1	9053.8	160.36	21.11	31.05	376
330	1.8122	6604.5	9363.6	161.31	21.09	30.91	382
340	1.7550	6823.1	9672.1	162.23	21.09	30.80	388
350	1.7016	7041.1	9979.5	163.12	21.08	30.69	393
360	1.6516	7258.5	10286.	163.98	21.08	30.60	399
370	1.6046	7475.5	10592.	164.82	21.08	30.53	405
380	1.5604	7692.2	10897.	165.63	21.09	30.46	410
390	1.5187	7908.5	11201.	166.43	21.10	30.40	415
400	1.4793	8124.6	11505.	167.19	21.11	30.35	420
420	1.4066	8556.3	12111.	168.67	21.14	30.28	431
440	1.3411	8987.7	12716.	170.08	21.19	30.24	440
460	1.2816	9419.2	13321.	171.42	21.24	30.22	450
480	1.2274	9851.2	13925.	172.71	21.31	30.22	459
500	1.1778	10284.	14529.	173.94	21.38	30.24	468
520	1.1321	10718.	15134.	175.13	21.47	30.27	477
540	1.0900	11153.	15740.	176.27	21.56	30.32	485
560	1.0509	11590.	16347.	177.38	21.66	30.38	494
580	1.0147	12028.	16956.	178.45	21.77	30.46	502
600	0.98087	12468.	17566.	179.48	21.88	30.54	510
620	0.94931	12910.	18177.	180.48	22.00	30.63	517

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
640	0.91976	13355.	18791.	181.46	22.13	30.73	525
660	0.89203	13801.	19407.	182.40	22.25	30.84	532
680	0.86595	14250.	20024.	183.33	22.38	30.94	540
700	0.84137	14702.	20644.	184.22	22.51	31.06	547
720	0.81818	15156.	21267.	185.10	22.65	31.17	554
740	0.79625	15612.	21891.	185.96	22.78	31.29	561
760	0.77548	16071.	22518.	186.79	22.91	31.41	568
780	0.75578	16532.	23148.	187.61	23.05	31.53	574
800	0.73707	16996.	23780.	188.41	23.18	31.66	581
850	0.69416	18167.	25370.	190.34	23.51	31.96	597
900	0.65601	19354.	26976.	192.17	23.83	32.26	613
950	0.62187	20556.	28596.	193.93	24.14	32.55	628
1000	0.59114	21772.	30231.	195.60	24.43	32.83	643
1050	0.56332	23003.	31879.	197.21	24.71	33.09	657
1100	0.53802	24247.	33540.	198.76	24.97	33.35	671
1150	0.51490	25503.	35213.	200.24	25.21	33.58	685
1200	0.49370	26771.	36898.	201.68	25.45	33.81	698
1250	0.47419	28050.	38594.	203.06	25.66	34.02	712
1300	0.45616	29339.	40300.	204.40	25.87	34.22	725
1350	0.43946	30638.	42015.	205.70	26.06	34.40	737
1400	0.42394	31946.	43740.	206.95	26.23	34.58	750
1450	0.40949	33262.	45473.	208.17	26.40	34.74	762
1500	0.39599	34587.	47213.	209.35	26.56	34.89	774
1550	0.38335	35919.	48962.	210.49	26.70	35.03	786
1600	0.37150	37258.	50717.	211.61	26.84	35.17	798
1650	0.36036	38603.	52478.	212.69	26.97	35.30	810
1700	0.34987	39955.	54246.	213.75	27.09	35.41	821
1750	0.33998	41313.	56020.	214.77	27.20	35.53	832
1800	0.33063	42676.	57799.	215.78	27.31	35.63	844
1850	0.32178	44044.	59583.	216.75	27.41	35.73	855
1900	0.31339	45417.	61372.	217.71	27.51	35.82	866
1950	0.30543	46795.	63165.	218.64	27.60	35.91	876
2000	0.29787	48177.	64963.	219.55	27.68	36.00	887
			6.00 MPa Isobar				
* 64.44	31.210	-4213.6	-4021.4	68.10	31.69	55.80	1045
66	30.984	-4128.2	-3934.6	69.43	31.52	55.64	1025
68	30.693	-4018.9	-3823.4	71.09	31.30	55.52	1001
70	30.401	-3909.8	-3712.5	72.70	31.08	55.46	978
72	30.108	-3800.8	-3601.6	74.26	30.86	55.46	956
74	29.812	-3691.9	-3490.6	75.78	30.64	55.51	935
76	29.513	-3582.8	-3379.5	77.27	30.42	55.60	914

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
78	29.211	-3473.6	-3268.2	78.71	30.19	55.73	894
80	28.905	-3364.1	-3156.5	80.12	29.97	55.89	874
82	28.596	-3254.4	-3044.6	81.51	29.74	56.08	855
84	28.283	-3144.3	-2932.2	82.86	29.52	56.30	836
86	27.965	-3033.9	-2819.3	84.19	29.29	56.55	817
88	27.643	-2923.0	-2705.9	85.49	29.07	56.84	798
90	27.315	-2811.6	-2592.0	86.77	28.86	57.15	780
92	26.982	-2699.7	-2477.3	88.03	28.64	57.50	761
94	26.643	-2587.1	-2361.9	89.27	28.43	57.89	742
96	26.297	-2473.9	-2245.7	90.50	28.22	58.32	724
98	25.943	-2359.9	-2128.6	91.70	28.02	58.81	705
100	25.582	-2245.0	-2010.4	92.90	27.83	59.36	686
102	25.212	-2129.1	-1891.1	94.08	27.64	59.97	667
104	24.832	-2012.1	-1770.5	95.25	27.46	60.67	647
106	24.441	-1893.9	-1648.4	96.41	27.28	61.47	627
108	24.038	-1774.1	-1524.5	97.57	27.12	62.39	607
110	23.620	-1652.7	-1398.7	98.72	26.96	63.45	587
112	23.187	-1529.4	-1270.6	99.88	26.82	64.68	566
114	22.735	-1403.7	-1139.8	101.04	26.69	66.13	544
116	22.261	-1275.4	-1005.9	102.20	26.57	67.85	522
118	21.761	-1143.9	-868.21	103.38	26.47	69.90	499
120	21.231	-1008.6	-726.01	104.57	26.40	72.37	475
122	20.665	-868.71	-578.37	105.79	26.35	75.38	451
124	20.054	-723.25	-424.05	107.05	26.34	79.06	426
126	19.389	-570.98	-261.53	108.35	26.36	83.62	400
128	18.658	-410.41	-88.84	109.71	26.44	89.28	374
130	17.847	-239.64	96.56	111.14	26.57	96.39	347
132	16.936	-56.23	298.04	112.68	26.76	105.5	321
134	15.905	142.98	520.23	114.35	27.00	117.2	295
136	14.732	361.14	768.43	116.19	27.25	131.2	271
138	13.438	596.48	1043.0	118.19	27.41	142.1	252
140	12.137	834.63	1329.0	120.25	27.35	141.8	239
142	10.973	1056.4	1603.2	122.20	27.04	131.3	232
144	10.006	1252.3	1852.0	123.94	26.60	117.3	229
146	9.2249	1422.5	2072.9	125.46	26.15	104.0	229
148	8.5927	1571.0	2269.2	126.80	25.72	92.77	230
150	8.0737	1702.3	2445.5	127.98	25.33	83.83	232
155	7.1059	1978.8	2823.2	130.46	24.55	68.64	238
160	6.4253	2208.1	3141.9	132.48	23.98	59.54	244
165	5.9110	2408.7	3423.8	134.22	23.54	53.61	251
170	5.5026	2590.6	3680.9	135.75	23.19	49.47	257
175	5.1670	2759.1	3920.4	137.14	22.91	46.44	263
180	4.8838	2917.9	4146.5	138.42	22.68	44.12	268
185	4.6401	3069.3	4362.4	139.60	22.48	42.30	274
190	4.4270	3214.7	4570.1	140.71	22.32	40.83	279

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
195	4.2384	3355.4	4771.1	141.75	22.18	39.62	284
200	4.0697	3492.3	4966.6	142.74	22.06	38.61	289
210	3.7792	3756.7	5344.3	144.58	21.87	37.02	299
220	3.5362	4011.6	5708.4	146.28	21.72	35.84	307
230	3.3288	4259.5	6062.0	147.85	21.60	34.92	316
240	3.1487	4501.9	6407.4	149.32	21.51	34.19	324
250	2.9905	4739.9	6746.2	150.70	21.43	33.60	332
260	2.8498	4974.3	7079.7	152.01	21.36	33.11	339
270	2.7237	5205.9	7408.8	153.25	21.31	32.71	346
280	2.6098	5435.1	7734.1	154.44	21.27	32.36	353
290	2.5062	5662.2	8056.2	155.57	21.23	32.07	360
300	2.4115	5887.6	8375.7	156.65	21.20	31.82	366
310	2.3245	6111.6	8692.8	157.69	21.18	31.60	373
320	2.2442	6334.3	9007.9	158.69	21.16	31.42	379
330	2.1698	6555.9	9321.2	159.65	21.14	31.25	385
340	2.1006	6776.6	9632.9	160.59	21.13	31.11	391
350	2.0361	6996.5	9943.4	161.48	21.12	30.98	396
360	1.9757	7215.7	10253.	162.36	21.12	30.87	402
370	1.9191	7434.4	10561.	163.20	21.12	30.78	408
380	1.8658	7652.5	10868.	164.02	21.13	30.69	413
390	1.8157	7870.3	11175.	164.82	21.13	30.62	418
400	1.7683	8087.7	11481.	165.59	21.14	30.56	423
420	1.6811	8521.9	12091.	167.08	21.17	30.47	434
440	1.6025	8955.5	12700.	168.50	21.21	30.40	443
460	1.5313	9389.0	13307.	169.85	21.27	30.36	453
480	1.4664	9822.7	13914.	171.14	21.33	30.35	462
500	1.4070	10257.	14521.	172.38	21.41	30.36	471
520	1.3525	10692.	15129.	173.57	21.49	30.38	480
540	1.3021	11129.	15737.	174.72	21.58	30.42	488
560	1.2555	11567.	16346.	175.82	21.68	30.48	496
580	1.2122	12006.	16956.	176.89	21.79	30.54	505
600	1.1718	12447.	17568.	177.93	21.90	30.62	512
620	1.1342	12891.	18181.	178.94	22.02	30.71	520
640	1.0989	13336.	18796.	179.91	22.14	30.80	528
660	1.0658	13784.	19413.	180.86	22.27	30.90	535
680	1.0347	14233.	20032.	181.79	22.40	31.01	542
700	1.0054	14685.	20653.	182.69	22.53	31.12	549
720	0.97773	15140.	21277.	183.56	22.66	31.23	556
740	0.95157	15597.	21902.	184.42	22.79	31.34	563
760	0.92680	16057.	22530.	185.26	22.92	31.46	570
780	0.90331	16519.	23161.	186.08	23.06	31.58	577
800	0.88099	16983.	23794.	186.88	23.19	31.70	583
850	0.82981	18156.	25386.	188.81	23.52	32.00	599
900	0.78432	19343.	26993.	190.65	23.84	32.29	615
950	0.74360	20546.	28615.	192.40	24.14	32.58	630

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1000	0.70694	21764.	30251.	194.08	24.44	32.85	645
1050	0.67375	22995.	31900.	195.69	24.71	33.12	659
1100	0.64356	24239.	33563.	197.23	24.98	33.37	673
1150	0.61598	25496.	35237.	198.72	25.22	33.60	687
1200	0.59068	26765.	36923.	200.16	25.45	33.82	700
1250	0.56739	28044.	38619.	201.54	25.67	34.03	714
1300	0.54587	29334.	40326.	202.88	25.87	34.23	727
1350	0.52593	30633.	42042.	204.18	26.06	34.41	739
1400	0.50740	31942.	43767.	205.43	26.24	34.59	752
1450	0.49014	33259.	45500.	206.65	26.41	34.75	764
1500	0.47402	34584.	47242.	207.83	26.56	34.90	776
1550	0.45893	35916.	48990.	208.98	26.71	35.04	788
1600	0.44477	37255.	50746.	210.09	26.84	35.18	800
1650	0.43146	38601.	52508.	211.17	26.97	35.30	812
1700	0.41893	39953.	54276.	212.23	27.09	35.42	823
1750	0.40710	41311.	56050.	213.26	27.21	35.53	834
1800	0.39593	42675.	57829.	214.26	27.31	35.64	845
1850	0.38535	44043.	59613.	215.24	27.42	35.74	856
1900	0.37533	45416.	61402.	216.19	27.51	35.83	867
1950	0.36581	46794.	63196.	217.12	27.60	35.92	878
2000	0.35677	48176.	64994.	218.03	27.68	36.00	889
			8.00 MPa Isobar				
* 64.87	31.262	-4208.2	-3952.3	68.18	31.85	55.57	1052
66	31.102	-4147.0	-3889.8	69.14	31.72	55.44	1037
68	30.817	-4038.7	-3779.1	70.79	31.49	55.28	1014
70	30.532	-3930.7	-3668.7	72.39	31.26	55.19	991
72	30.245	-3822.8	-3558.3	73.94	31.04	55.16	969
74	29.957	-3715.0	-3448.0	75.45	30.81	55.17	948
76	29.666	-3607.3	-3337.6	76.93	30.58	55.22	928
78	29.372	-3499.4	-3227.1	78.36	30.35	55.31	909
80	29.076	-3391.5	-3116.3	79.76	30.12	55.43	890
82	28.776	-3283.4	-3005.3	81.13	29.89	55.57	871
84	28.473	-3175.0	-2894.0	82.48	29.66	55.74	852
86	28.166	-3066.4	-2782.4	83.79	29.44	55.93	834
88	27.855	-2957.5	-2670.3	85.08	29.21	56.15	816
90	27.540	-2848.2	-2557.8	86.34	28.99	56.39	798
92	27.221	-2738.6	-2444.7	87.58	28.77	56.66	781
94	26.897	-2628.5	-2331.1	88.81	28.56	56.95	763
96	26.567	-2518.0	-2216.9	90.01	28.35	57.28	745
98	26.232	-2406.9	-2102.0	91.19	28.14	57.64	728
100	25.890	-2295.3	-1986.3	92.36	27.94	58.04	710

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
102	25.543	-2183.0	-1869.8	93.52	27.75	58.49	692
104	25.187	-2069.9	-1752.3	94.66	27.56	58.98	674
106	24.824	-1956.1	-1633.8	95.78	27.37	59.54	656
108	24.453	-1841.3	-1514.1	96.90	27.20	60.16	638
110	24.072	-1725.5	-1393.1	98.01	27.03	60.86	620
112	23.680	-1608.5	-1270.6	99.12	26.86	61.65	601
114	23.276	-1490.2	-1146.5	100.22	26.71	62.54	582
116	22.859	-1370.4	-1020.4	101.31	26.57	63.56	563
118	22.428	-1248.8	-892.14	102.41	26.43	64.72	543
120	21.980	-1125.4	-761.41	103.51	26.31	66.04	524
122	21.513	-999.73	-627.86	104.61	26.20	67.55	503
124	21.024	-871.58	-491.07	105.72	26.11	69.28	483
126	20.512	-740.60	-350.59	106.85	26.03	71.24	463
128	19.973	-606.47	-205.93	107.98	25.96	73.46	442
130	19.405	-468.84	-56.56	109.14	25.92	75.95	422
132	18.804	-327.39	98.05	110.32	25.89	78.71	401
134	18.169	-181.88	258.43	111.53	25.88	81.71	382
136	17.499	-32.13	425.04	112.76	25.88	84.94	363
138	16.793	121.89	598.28	114.03	25.89	88.31	345
140	16.054	279.99	778.30	115.32	25.89	91.69	328
142	15.287	441.49	964.80	116.65	25.88	94.70	313
144	14.504	604.93	1156.5	117.99	25.85	96.78	300
146	13.723	767.96	1350.9	119.33	25.79	97.35	289
148	12.965	927.72	1544.7	120.65	25.70	96.20	280
150	12.250	1081.7	1734.7	121.92	25.57	93.56	273
155	10.710	1432.0	2179.0	124.83	25.16	83.71	265
160	9.5255	1731.7	2571.6	127.33	24.68	73.56	263
165	8.6195	1989.7	2917.8	129.46	24.23	65.31	265
170	7.9115	2216.8	3228.0	131.31	23.83	59.04	269
175	7.3431	2421.4	3510.8	132.95	23.49	54.32	273
180	6.8747	2609.3	3773.0	134.43	23.20	50.71	277
185	6.4804	2784.7	4019.2	135.78	22.96	47.88	282
190	6.1423	2950.3	4252.8	137.02	22.75	45.63	287
195	5.8481	3108.3	4476.2	138.19	22.58	43.81	292
200	5.5889	3260.0	4691.4	139.28	22.42	42.30	296
210	5.1508	3548.8	5102.0	141.28	22.17	39.96	305
220	4.7920	3823.2	5492.6	143.10	21.98	38.24	314
230	4.4907	4086.8	5868.2	144.77	21.83	36.94	322
240	4.2328	4342.3	6232.3	146.32	21.71	35.92	330
250	4.0086	4591.5	6587.2	147.77	21.61	35.10	338
260	3.8112	4835.6	6934.7	149.13	21.53	34.43	345
270	3.6355	5075.6	7276.1	150.42	21.46	33.87	352
280	3.4779	5312.2	7612.5	151.64	21.40	33.41	359
290	3.3354	5546.0	7944.5	152.81	21.35	33.01	366
300	3.2057	5777.3	8272.9	153.92	21.32	32.67	372

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
310	3.0871	6006.7	8598.1	154.98	21.28	32.38	379
320	2.9780	6234.2	8920.6	156.01	21.26	32.13	385
330	2.8773	6460.3	9240.7	156.99	21.23	31.91	391
340	2.7839	6685.1	9558.8	157.94	21.22	31.71	397
350	2.6970	6908.8	9875.0	158.86	21.21	31.54	403
360	2.6159	7131.5	10190.	159.75	21.20	31.39	408
370	2.5400	7353.4	10503.	160.61	21.20	31.26	414
380	2.4688	7574.6	10815.	161.44	21.20	31.15	419
390	2.4018	7795.2	11126.	162.25	21.20	31.05	424
400	2.3386	8015.3	11436.	163.03	21.21	30.96	430
420	2.2224	8454.2	12054.	164.54	21.23	30.82	440
440	2.1180	8892.1	12669.	165.97	21.27	30.72	450
460	2.0235	9329.5	13283.	167.33	21.32	30.65	459
480	1.9376	9766.7	13896.	168.64	21.38	30.61	468
500	1.8590	10204.	14508.	169.89	21.45	30.60	477
520	1.7869	10642.	15120.	171.09	21.53	30.60	486
540	1.7203	11082.	15732.	172.24	21.62	30.62	494
560	1.6588	11522.	16345.	173.36	21.72	30.66	502
580	1.6017	11964.	16958.	174.43	21.82	30.71	510
600	1.5485	12407.	17573.	175.47	21.94	30.78	518
620	1.4988	12852.	18190.	176.48	22.05	30.85	526
640	1.4524	13299.	18807.	177.47	22.17	30.94	533
660	1.4088	13748.	19427.	178.42	22.30	31.03	541
680	1.3678	14200.	20049.	179.35	22.42	31.12	548
700	1.3292	14653.	20672.	180.25	22.55	31.23	555
720	1.2928	15109.	21298.	181.13	22.69	31.33	562
740	1.2583	15568.	21925.	181.99	22.82	31.44	569
760	1.2257	16028.	22555.	182.83	22.95	31.55	575
780	1.1948	16492.	23188.	183.65	23.08	31.67	582
800	1.1654	16957.	23822.	184.46	23.21	31.78	589
850	1.0980	18132.	25418.	186.39	23.54	32.07	605
900	1.0381	19322.	27029.	188.23	23.86	32.36	620
950	0.98444	20527.	28654.	189.99	24.16	32.63	635
1000	0.93615	21747.	30292.	191.67	24.45	32.90	650
1050	0.89242	22979.	31944.	193.28	24.73	33.16	664
1100	0.85263	24225.	33608.	194.83	24.99	33.41	678
1150	0.81626	25483.	35284.	196.32	25.24	33.64	691
1200	0.78290	26753.	36972.	197.76	25.47	33.86	705
1250	0.75217	28034.	38670.	199.14	25.68	34.06	718
1300	0.72378	29325.	40378.	200.48	25.89	34.26	731
1350	0.69747	30625.	42095.	201.78	26.07	34.44	743
1400	0.67301	31934.	43821.	203.03	26.25	34.61	756
1450	0.65022	33252.	45556.	204.25	26.42	34.77	768
1500	0.62892	34578.	47298.	205.43	26.57	34.92	780
1550	0.60899	35911.	49047.	206.58	26.72	35.06	792

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1600	0.59028	37251.	50804.	207.70	26.85	35.19	804
1650	0.57269	38597.	52566.	208.78	26.98	35.32	815
1700	0.55613	39950.	54335.	209.84	27.10	35.43	827
1750	0.54049	41308.	56110.	210.86	27.22	35.54	838
1800	0.52572	42672.	57889.	211.87	27.32	35.65	849
1850	0.51173	44041.	59674.	212.85	27.42	35.75	860
1900	0.49847	45415.	61464.	213.80	27.52	35.84	871
1950	0.48588	46793.	63258.	214.73	27.61	35.93	881
2000	0.47391	48176.	65056.	215.64	27.69	36.01	892
			10.00 MPa Isobar				
* 65.30	31.313	-4202.7	-3883.3	68.26	32.01	55.34	1057
66	31.216	-4165.1	-3844.7	68.85	31.92	55.26	1049
68	30.937	-4057.7	-3734.4	70.49	31.69	55.07	1025
70	30.658	-3950.6	-3624.4	72.09	31.45	54.95	1003
72	30.378	-3843.8	-3514.6	73.63	31.21	54.88	982
74	30.096	-3737.2	-3404.9	75.14	30.98	54.86	961
76	29.812	-3630.6	-3295.1	76.60	30.74	54.88	942
78	29.526	-3524.0	-3185.3	78.03	30.51	54.93	923
80	29.238	-3417.4	-3075.4	79.42	30.28	55.01	904
82	28.947	-3310.7	-2965.3	80.78	30.04	55.12	886
84	28.653	-3203.9	-2854.9	82.11	29.81	55.24	868
86	28.356	-3097.0	-2744.3	83.41	29.58	55.39	850
88	28.056	-2989.8	-2633.4	84.68	29.36	55.55	833
90	27.752	-2882.4	-2522.1	85.93	29.13	55.74	816
92	27.444	-2774.8	-2410.4	87.16	28.91	55.94	799
94	27.133	-2666.9	-2298.3	88.37	28.70	56.16	782
96	26.817	-2558.6	-2185.7	89.55	28.48	56.41	765
98	26.497	-2450.0	-2072.6	90.72	28.28	56.68	749
100	26.172	-2341.1	-1959.0	91.87	28.07	56.98	732
102	25.842	-2231.7	-1844.7	93.00	27.87	57.30	715
104	25.507	-2121.8	-1729.8	94.11	27.68	57.66	699
106	25.166	-2011.4	-1614.1	95.22	27.49	58.05	682
108	24.819	-1900.4	-1497.5	96.30	27.31	58.49	665
110	24.464	-1788.8	-1380.1	97.38	27.13	58.97	648
112	24.103	-1676.5	-1261.6	98.45	26.96	59.50	631
114	23.733	-1563.4	-1142.0	99.51	26.80	60.09	614
116	23.355	-1449.4	-1021.2	100.56	26.64	60.74	597
118	22.967	-1334.4	-899.03	101.60	26.50	61.47	579
120	22.569	-1218.4	-775.30	102.64	26.36	62.27	562
122	22.159	-1101.2	-649.88	103.68	26.23	63.16	544
124	21.738	-982.61	-522.58	104.71	26.10	64.15	527

Table 22. Thermodynamic properties of nitrogen–Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
126	21.303	-862.66	-393.23	105.75	25.99	65.22	509
128	20.853	-741.17	-261.62	106.79	25.89	66.40	491
130	20.388	-618.04	-127.57	107.82	25.80	67.67	474
132	19.908	-493.20	9.12	108.87	25.71	69.03	457
134	19.410	-366.61	148.58	109.92	25.64	70.45	440
136	18.896	-238.26	290.94	110.97	25.58	71.92	423
138	18.366	-108.21	436.26	112.03	25.52	73.40	407
140	17.821	23.39	584.54	113.10	25.47	74.87	392
142	17.261	156.37	735.69	114.17	25.43	76.27	378
144	16.691	290.41	889.54	115.25	25.38	77.55	365
146	16.112	425.11	1045.8	116.32	25.33	78.63	353
148	15.530	559.93	1203.8	117.40	25.27	79.40	341
150	14.949	694.16	1363.1	118.47	25.21	79.77	332
155	13.545	1021.8	1760.1	121.07	25.01	78.49	312
160	12.277	1329.0	2143.5	123.51	24.76	74.58	301
165	11.188	1610.1	2503.9	125.72	24.46	69.46	295
170	10.276	1864.9	2838.1	127.72	24.15	64.29	293
175	9.5149	2096.7	3147.7	129.52	23.85	59.65	293
180	8.8773	2309.3	3435.8	131.14	23.56	55.70	294
185	8.3372	2506.3	3705.8	132.62	23.31	52.42	297
190	7.8740	2690.9	3960.9	133.98	23.08	49.70	300
195	7.4721	2865.3	4203.6	135.24	22.89	47.45	304
200	7.1196	3031.4	4436.0	136.42	22.72	45.57	307
210	6.5280	3344.3	4876.2	138.57	22.43	42.63	315
220	6.0484	3637.9	5291.2	140.50	22.21	40.46	323
230	5.6496	3917.2	5687.2	142.26	22.03	38.82	331
240	5.3109	4185.8	6068.7	143.88	21.89	37.53	338
250	5.0186	4446.1	6438.6	145.39	21.77	36.50	346
260	4.7629	4699.7	6799.3	146.81	21.67	35.66	353
270	4.5367	4948.1	7152.3	148.14	21.59	34.97	360
280	4.3346	5192.0	7499.0	149.40	21.52	34.39	367
290	4.1527	5432.3	7840.4	150.60	21.47	33.90	373
300	3.9877	5669.5	8177.2	151.74	21.42	33.48	380
310	3.8373	5904.1	8510.1	152.83	21.38	33.11	386
320	3.6994	6136.5	8839.6	153.88	21.35	32.80	392
330	3.5724	6366.9	9166.2	154.88	21.32	32.53	398
340	3.4548	6595.7	9490.2	155.85	21.30	32.29	404
350	3.3457	6823.1	9812.0	156.78	21.28	32.07	409
360	3.2441	7049.2	10132.	157.68	21.27	31.89	415
370	3.1490	7274.3	10450.	158.55	21.27	31.73	420
380	3.0600	7498.4	10766.	159.40	21.26	31.58	426
390	2.9764	7721.8	11082.	160.22	21.26	31.46	431
400	2.8976	7944.4	11396.	161.01	21.27	31.35	436
420	2.7530	8388.1	12021.	162.54	21.29	31.16	446
440	2.6232	8830.2	12642.	163.98	21.32	31.03	456

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
460	2.5059	9271.3	13262.	165.36	21.37	30.93	465
480	2.3994	9711.9	13880.	166.68	21.42	30.86	474
500	2.3020	10153.	14497.	167.93	21.49	30.82	483
520	2.2127	10594.	15113.	169.14	21.57	30.81	492
540	2.1305	11035.	15729.	170.31	21.66	30.81	500
560	2.0544	11478.	16345.	171.43	21.76	30.84	508
580	1.9838	11922.	16963.	172.51	21.86	30.88	516
600	1.9181	12367.	17581.	173.56	21.97	30.93	524
620	1.8568	12814.	18200.	174.57	22.08	30.99	532
640	1.7994	13263.	18820.	175.56	22.20	31.07	539
660	1.7456	13714.	19443.	176.51	22.33	31.15	546
680	1.6950	14167.	20067.	177.45	22.45	31.24	553
700	1.6474	14622.	20692.	178.35	22.58	31.33	560
720	1.6024	15079.	21320.	179.24	22.71	31.43	567
740	1.5599	15539.	21950.	180.10	22.84	31.54	574
760	1.5196	16001.	22581.	180.94	22.97	31.64	581
780	1.4815	16465.	23215.	181.76	23.11	31.75	587
800	1.4452	16932.	23851.	182.57	23.24	31.86	594
850	1.3620	18109.	25451.	184.51	23.56	32.14	610
900	1.2881	19302.	27065.	186.35	23.88	32.42	625
950	1.2218	20509.	28693.	188.11	24.18	32.69	640
1000	1.1622	21730.	30334.	189.80	24.47	32.95	654
1050	1.1082	22964.	31988.	191.41	24.75	33.20	669
1100	1.0590	24211.	33654.	192.96	25.01	33.44	682
1150	1.0141	25471.	35332.	194.45	25.25	33.67	696
1200	0.97282	26742.	37021.	195.89	25.48	33.89	709
1250	0.93483	28023.	38721.	197.28	25.70	34.09	722
1300	0.89971	29315.	40430.	198.62	25.90	34.28	735
1350	0.86715	30617.	42149.	199.92	26.09	34.46	748
1400	0.83689	31927.	43876.	201.17	26.26	34.63	760
1450	0.80867	33245.	45611.	202.39	26.43	34.79	772
1500	0.78231	34572.	47354.	203.57	26.58	34.94	784
1550	0.75762	35906.	49105.	204.72	26.73	35.08	796
1600	0.73445	37246.	50862.	205.84	26.86	35.21	807
1650	0.71266	38593.	52625.	206.92	26.99	35.33	819
1700	0.69213	39947.	54395.	207.98	27.11	35.45	830
1750	0.67275	41305.	56170.	209.01	27.23	35.56	841
1800	0.65443	42670.	57950.	210.01	27.33	35.66	852
1850	0.63709	44039.	59736.	210.99	27.43	35.76	863
1900	0.62064	45413.	61526.	211.94	27.53	35.85	874
1950	0.60503	46792.	63320.	212.88	27.62	35.93	885
2000	0.59018	48175.	65119.	213.79	27.70	36.02	895

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
			15.00 MPa Isobar				
* 66.36	31.439	-4188.2	-3711.1	68.45	32.39	54.81	1071
68	31.221	-4101.8	-3621.4	69.79	32.18	54.61	1052
70	30.956	-3996.9	-3512.4	71.37	31.92	54.42	1031
72	30.690	-3892.4	-3403.7	72.90	31.66	54.29	1011
74	30.423	-3788.2	-3295.2	74.39	31.41	54.21	991
76	30.155	-3684.3	-3186.8	75.83	31.16	54.16	973
78	29.886	-3580.5	-3078.5	77.24	30.91	54.14	955
80	29.615	-3476.8	-2970.3	78.61	30.67	54.14	937
82	29.342	-3373.2	-2862.0	79.95	30.43	54.17	920
84	29.068	-3269.6	-2753.6	81.25	30.19	54.22	903
86	28.791	-3166.1	-2645.1	82.53	29.96	54.27	887
88	28.512	-3062.5	-2536.5	83.78	29.72	54.35	871
90	28.232	-2959.0	-2427.7	85.00	29.50	54.43	855
92	27.948	-2855.4	-2318.7	86.20	29.27	54.53	840
94	27.663	-2751.8	-2209.6	87.37	29.05	54.63	825
96	27.375	-2648.1	-2100.2	88.52	28.83	54.75	809
98	27.084	-2544.4	-1990.6	89.65	28.62	54.87	794
100	26.791	-2440.6	-1880.7	90.76	28.42	55.01	780
102	26.495	-2336.7	-1770.6	91.85	28.21	55.15	765
104	26.196	-2232.7	-1660.1	92.92	28.02	55.31	750
106	25.894	-2128.6	-1549.3	93.98	27.82	55.48	735
108	25.589	-2024.4	-1438.2	95.02	27.64	55.66	721
110	25.281	-1920.0	-1326.6	96.04	27.45	55.86	707
112	24.969	-1815.4	-1214.7	97.05	27.28	56.08	692
114	24.654	-1710.7	-1102.3	98.04	27.10	56.31	678
116	24.335	-1605.9	-989.47	99.03	26.94	56.55	664
118	24.012	-1500.8	-876.10	100.00	26.78	56.82	649
120	23.685	-1395.5	-762.18	100.95	26.62	57.10	635
122	23.354	-1290.0	-647.67	101.90	26.48	57.41	621
124	23.019	-1184.2	-532.54	102.83	26.33	57.73	607
126	22.679	-1078.1	-416.74	103.76	26.20	58.07	593
128	22.335	-971.85	-300.25	104.68	26.06	58.43	579
130	21.985	-865.29	-183.02	105.59	25.94	58.80	566
132	21.632	-758.46	-65.03	106.49	25.82	59.19	552
134	21.273	-651.37	53.75	107.38	25.71	59.58	539
136	20.910	-544.05	173.31	108.27	25.60	59.98	526
138	20.542	-436.53	293.68	109.15	25.50	60.38	513
140	20.170	-328.84	414.83	110.02	25.40	60.77	501
142	19.794	-221.04	536.75	110.88	25.31	61.14	489
144	19.415	-113.20	659.39	111.74	25.22	61.49	478

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
146	19.033	-5.40	782.70	112.59	25.14	61.81	467
148	18.649	102.29	906.61	113.43	25.06	62.09	456
150	18.264	209.73	1031.0	114.27	24.98	62.32	446
155	17.301	476.59	1343.6	116.32	24.80	62.65	423
160	16.351	739.38	1656.7	118.31	24.62	62.53	404
165	15.431	996.02	1968.1	120.22	24.44	61.91	389
170	14.557	1244.6	2275.0	122.05	24.26	60.78	376
175	13.739	1483.5	2575.2	123.80	24.07	59.24	367
180	12.987	1711.9	2867.0	125.44	23.88	57.43	361
185	12.300	1929.8	3149.3	126.99	23.69	55.49	357
190	11.678	2137.3	3421.8	128.44	23.51	53.54	354
195	11.115	2335.3	3684.8	129.81	23.33	51.66	353
200	10.607	2524.5	3938.7	131.09	23.16	49.91	352
210	9.7310	2880.3	4421.8	133.45	22.87	46.82	354
220	9.0056	3211.4	4877.0	135.57	22.62	44.31	357
230	8.3965	3523.2	5309.6	137.49	22.41	42.28	361
240	7.8777	3819.8	5723.9	139.25	22.24	40.64	367
250	7.4301	4104.5	6123.3	140.89	22.10	39.29	372
260	7.0392	4379.5	6510.5	142.40	21.98	38.17	378
270	6.6944	4646.7	6887.4	143.83	21.88	37.24	383
280	6.3875	4907.4	7255.7	145.17	21.79	36.45	389
290	6.1122	5162.7	7616.8	146.43	21.72	35.78	395
300	5.8635	5413.4	7971.6	147.64	21.65	35.20	401
310	5.6373	5660.3	8321.1	148.78	21.60	34.70	406
320	5.4306	5903.8	8665.9	149.88	21.56	34.27	412
330	5.2408	6144.4	9006.6	150.93	21.52	33.88	418
340	5.0657	6382.6	9343.7	151.93	21.49	33.55	423
350	4.9035	6618.6	9677.7	152.90	21.46	33.25	428
360	4.7527	6852.8	10009.	153.83	21.44	32.99	434
370	4.6121	7085.3	10338.	154.73	21.43	32.76	439
380	4.4806	7316.4	10664.	155.60	21.42	32.55	444
390	4.3573	7546.2	10989.	156.45	21.41	32.37	449
400	4.2414	7775.0	11312.	157.26	21.41	32.21	454
420	4.0289	8229.8	11953.	158.83	21.42	31.93	463
440	3.8388	8681.7	12589.	160.31	21.44	31.72	473
460	3.6673	9131.7	13222.	161.72	21.48	31.55	482
480	3.5118	9580.4	13852.	163.06	21.53	31.43	491
500	3.3699	10028.	14479.	164.34	21.60	31.34	499
520	3.2399	10476.	15106.	165.57	21.67	31.29	508
540	3.1202	10924.	15731.	166.75	21.75	31.26	516
560	3.0096	11372.	16356.	167.88	21.84	31.25	524
580	2.9070	11821.	16981.	168.98	21.94	31.25	531
600	2.8116	12271.	17606.	170.04	22.05	31.28	539
620	2.7226	12723.	18232.	171.06	22.16	31.32	546
640	2.6393	13176.	18859.	172.06	22.28	31.37	554

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
660	2.5612	13631.	19487.	173.03	22.40	31.44	561
680	2.4878	14087.	20117.	173.97	22.52	31.51	568
700	2.4186	14546.	20748.	174.88	22.65	31.58	574
720	2.3534	15006.	21380.	175.77	22.77	31.67	581
740	2.2917	15469.	22014.	176.64	22.90	31.76	588
760	2.2333	15934.	22651.	177.49	23.03	31.85	594
780	2.1779	16401.	23289.	178.32	23.16	31.95	601
800	2.1252	16870.	23929.	179.13	23.29	32.05	607
850	2.0044	18054.	25537.	181.08	23.61	32.30	623
900	1.8969	19251.	27159.	182.93	23.93	32.56	638
950	1.8007	20463.	28793.	184.70	24.23	32.82	652
1000	1.7139	21688.	30441.	186.39	24.51	33.07	666
1050	1.6352	22927.	32100.	188.01	24.79	33.31	680
1100	1.5636	24178.	33771.	189.56	25.05	33.54	694
1150	1.4980	25440.	35453.	191.06	25.29	33.76	707
1200	1.4378	26714.	37146.	192.50	25.52	33.96	720
			20.00 MPa Isobar				
* 67.41	31.561	-4172.8	-3539.1	68.65	32.75	54.33	1084
68	31.486	-4142.0	-3506.8	69.13	32.66	54.24	1077
70	31.232	-4038.9	-3398.5	70.70	32.38	54.00	1057
72	30.979	-3936.3	-3290.7	72.22	32.10	53.82	1037
74	30.725	-3834.2	-3183.2	73.69	31.83	53.68	1019
76	30.470	-3732.4	-3076.0	75.12	31.56	53.58	1001
78	30.214	-3630.9	-2968.9	76.51	31.30	53.50	984
80	29.958	-3529.6	-2862.0	77.86	31.05	53.46	967
82	29.700	-3428.5	-2755.1	79.18	30.80	53.43	951
84	29.442	-3327.5	-2648.2	80.47	30.55	53.42	936
86	29.182	-3226.8	-2541.4	81.73	30.31	53.42	920
88	28.920	-3126.1	-2434.6	82.96	30.07	53.43	905
90	28.657	-3025.6	-2327.7	84.16	29.84	53.45	891
92	28.393	-2925.2	-2220.8	85.33	29.61	53.48	876
94	28.127	-2824.8	-2113.8	86.48	29.39	53.51	862
96	27.860	-2724.6	-2006.7	87.61	29.17	53.55	848
98	27.591	-2624.5	-1899.6	88.71	28.95	53.59	834
100	27.321	-2524.4	-1792.4	89.80	28.75	53.64	820
102	27.049	-2424.4	-1685.0	90.86	28.54	53.69	807
104	26.775	-2324.6	-1577.6	91.90	28.34	53.75	794
106	26.500	-2224.8	-1470.1	92.93	28.15	53.81	781
108	26.223	-2125.1	-1362.4	93.93	27.96	53.87	768
110	25.945	-2025.4	-1254.6	94.92	27.77	53.94	755
112	25.665	-1925.9	-1146.6	95.90	27.59	54.01	742

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
114	25.383	-1826.4	-1038.5	96.85	27.42	54.09	729
116	25.099	-1727.1	-930.24	97.79	27.25	54.18	717
118	24.814	-1627.8	-821.80	98.72	27.09	54.27	704
120	24.527	-1528.6	-713.18	99.63	26.93	54.36	692
122	24.239	-1429.5	-604.36	100.53	26.77	54.46	680
124	23.948	-1330.5	-495.33	101.42	26.62	54.56	668
126	23.656	-1231.6	-386.10	102.29	26.48	54.67	656
128	23.362	-1132.7	-276.63	103.15	26.34	54.79	644
130	23.066	-1034.0	-166.94	104.01	26.20	54.90	632
132	22.769	-935.41	-57.01	104.84	26.07	55.02	621
134	22.470	-836.92	53.15	105.67	25.95	55.14	609
136	22.169	-738.58	163.56	106.49	25.83	55.26	598
138	21.867	-640.39	274.21	107.30	25.71	55.38	588
140	21.564	-542.37	385.09	108.10	25.60	55.50	577
142	21.260	-444.55	496.19	108.88	25.50	55.61	566
144	20.954	-346.95	607.51	109.66	25.39	55.70	556
146	20.648	-249.60	719.01	110.43	25.30	55.79	547
148	20.342	-152.53	830.67	111.19	25.20	55.87	537
150	20.035	-55.79	942.48	111.94	25.11	55.93	528
155	19.269	184.40	1222.4	113.78	24.90	56.00	506
160	18.509	421.67	1502.2	115.55	24.70	55.93	487
165	17.761	655.31	1781.4	117.27	24.51	55.70	470
170	17.031	884.60	2058.9	118.93	24.34	55.29	455
175	16.325	1108.9	2334.0	120.52	24.17	54.71	443
180	15.648	1327.6	2605.8	122.05	24.00	53.97	432
185	15.004	1540.4	2873.4	123.52	23.84	53.08	424
190	14.395	1746.9	3136.4	124.92	23.69	52.08	417
195	13.822	1947.2	3394.1	126.26	23.54	51.02	412
200	13.286	2141.2	3646.5	127.54	23.39	49.91	408
210	12.321	2511.3	4134.6	129.92	23.12	47.72	403
220	11.484	2859.9	4601.4	132.10	22.89	45.68	401
230	10.759	3189.9	5048.8	134.08	22.68	43.85	401
240	10.127	3504.3	5479.3	135.92	22.50	42.27	403
250	9.5726	3805.7	5895.0	137.61	22.35	40.91	406
260	9.0832	4096.2	6298.1	139.19	22.22	39.74	409
270	8.6479	4377.6	6690.3	140.68	22.10	38.74	413
280	8.2582	4651.4	7073.3	142.07	22.01	37.87	417
290	7.9071	4918.7	7448.1	143.38	21.92	37.12	422
300	7.5889	5180.5	7815.9	144.63	21.85	36.46	426
310	7.2990	5437.5	8177.6	145.82	21.79	35.89	431
320	7.0336	5690.4	8534.0	146.95	21.74	35.39	436
330	6.7895	5939.8	8885.5	148.03	21.69	34.94	440
340	6.5642	6186.1	9232.9	149.07	21.65	34.54	445
350	6.3554	6429.6	9576.6	150.06	21.62	34.19	450
360	6.1612	6670.8	9916.9	151.02	21.59	33.88	455

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
370	5.9801	6909.9	10254.	151.95	21.57	33.60	459
380	5.8108	7147.1	10589.	152.84	21.56	33.35	464
390	5.6519	7382.7	10921.	153.70	21.55	33.12	469
400	5.5025	7616.9	11252.	154.54	21.54	32.92	473
420	5.2289	8081.7	11907.	156.14	21.54	32.58	482
440	4.9841	8542.6	12555.	157.65	21.56	32.31	491
460	4.7633	9000.6	13199.	159.08	21.59	32.10	500
480	4.5632	9456.6	13839.	160.44	21.64	31.93	508
500	4.3806	9911.1	14477.	161.74	21.69	31.80	516
520	4.2133	10365.	15112.	162.99	21.76	31.71	524
540	4.0593	10818.	15745.	164.18	21.84	31.65	532
560	3.9169	11272.	16378.	165.33	21.93	31.61	540
580	3.7850	11726.	17010.	166.44	22.02	31.59	547
600	3.6622	12180.	17642.	167.51	22.13	31.60	554
620	3.5476	12636.	18274.	168.55	22.23	31.62	561
640	3.4404	13093.	18906.	169.55	22.35	31.65	568
660	3.3399	13551.	19540.	170.53	22.47	31.69	575
680	3.2454	14011.	20174.	171.47	22.59	31.75	582
700	3.1563	14473.	20810.	172.39	22.71	31.81	589
720	3.0723	14937.	21447.	173.29	22.84	31.89	595
740	2.9928	15403.	22085.	174.17	22.96	31.96	602
760	2.9175	15870.	22725.	175.02	23.09	32.05	608
780	2.8461	16340.	23367.	175.85	23.22	32.13	614
800	2.7782	16812.	24011.	176.67	23.35	32.22	620
850	2.6223	18001.	25628.	178.63	23.66	32.46	636
900	2.4835	19203.	27256.	180.49	23.97	32.70	650
950	2.3591	20419.	28897.	182.26	24.27	32.94	664
1000	2.2469	21649.	30550.	183.96	24.56	33.17	678
1050	2.1451	22891.	32214.	185.58	24.83	33.40	692
1100	2.0523	24145.	33890.	187.14	25.08	33.62	705
1150	1.9674	25411.	35576.	188.64	25.32	33.83	718
1200	1.8893	26687.	37273.	190.09	25.55	34.03	731
			25.00 MPa Isobar				
* 68.42	31.682	-4157.3	-3368.2	68.84	33.06	53.88	1097
70	31.490	-4077.1	-3283.2	70.07	32.81	53.66	1081
72	31.247	-3976.2	-3176.2	71.58	32.51	53.43	1063
74	31.004	-3875.8	-3069.5	73.04	32.22	53.24	1045
76	30.761	-3775.9	-2963.2	74.46	31.94	53.10	1028
78	30.518	-3676.3	-2857.1	75.83	31.67	52.99	1011
80	30.274	-3577.0	-2751.2	77.17	31.40	52.90	995
82	30.029	-3478.0	-2645.5	78.48	31.14	52.83	980

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
84	29.783	-3379.3	-2539.9	79.75	30.89	52.78	965
86	29.537	-3280.8	-2434.4	80.99	30.64	52.73	951
88	29.289	-3182.5	-2328.9	82.20	30.40	52.70	937
90	29.041	-3084.4	-2223.6	83.39	30.16	52.68	923
92	28.792	-2986.5	-2118.2	84.55	29.93	52.66	909
94	28.542	-2888.8	-2012.9	85.68	29.70	52.65	896
96	28.291	-2791.3	-1907.6	86.79	29.48	52.64	883
98	28.039	-2694.0	-1802.4	87.87	29.26	52.63	870
100	27.787	-2596.8	-1697.1	88.94	29.05	52.62	857
102	27.533	-2499.9	-1591.9	89.98	28.84	52.62	845
104	27.279	-2403.1	-1486.7	91.00	28.64	52.61	832
106	27.024	-2306.5	-1381.4	92.00	28.45	52.61	820
108	26.767	-2210.2	-1276.2	92.98	28.26	52.61	808
110	26.511	-2114.0	-1171.0	93.95	28.07	52.61	796
112	26.253	-2018.0	-1065.8	94.90	27.89	52.61	785
114	25.995	-1922.3	-960.54	95.83	27.71	52.61	773
116	25.736	-1826.7	-855.31	96.74	27.54	52.62	762
118	25.476	-1731.4	-750.08	97.64	27.38	52.62	750
120	25.215	-1636.3	-644.83	98.53	27.21	52.62	739
122	24.954	-1541.4	-539.58	99.40	27.06	52.63	728
124	24.692	-1446.8	-434.31	100.25	26.90	52.64	717
126	24.430	-1352.4	-329.04	101.10	26.76	52.64	707
128	24.167	-1258.2	-223.74	101.93	26.61	52.65	696
130	23.904	-1164.3	-118.44	102.74	26.48	52.66	686
132	23.640	-1070.6	-13.12	103.55	26.34	52.67	676
134	23.376	-977.25	92.22	104.34	26.21	52.67	666
136	23.111	-884.14	197.57	105.12	26.09	52.68	656
138	22.847	-791.32	302.94	105.89	25.97	52.68	646
140	22.582	-698.79	408.31	106.65	25.85	52.69	636
142	22.317	-606.56	513.68	107.39	25.73	52.68	627
144	22.052	-514.66	619.04	108.13	25.62	52.68	618
146	21.787	-423.09	724.39	108.86	25.52	52.67	609
148	21.522	-331.88	829.72	109.57	25.42	52.65	601
150	21.258	-241.03	935.00	110.28	25.32	52.63	592
155	20.600	-15.62	1198.0	112.00	25.08	52.54	572
160	19.948	207.10	1460.4	113.67	24.87	52.40	554
165	19.305	426.81	1721.8	115.28	24.67	52.18	537
170	18.673	643.20	1982.0	116.83	24.49	51.89	522
175	18.056	855.98	2240.6	118.33	24.31	51.52	508
180	17.456	1064.9	2497.1	119.78	24.15	51.07	496
185	16.875	1269.6	2751.1	121.17	23.99	50.54	486
190	16.316	1470.1	3002.4	122.51	23.84	49.95	477
195	15.780	1666.2	3250.5	123.80	23.70	49.30	470
200	15.268	1857.8	3495.3	125.04	23.56	48.61	464
210	14.317	2227.8	3974.1	127.37	23.31	47.14	454

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
220	13.462	2580.8	4437.9	129.53	23.09	45.64	448
230	12.697	2918.1	4887.0	131.53	22.88	44.20	444
240	12.014	3241.3	5322.2	133.38	22.71	42.86	443
250	11.403	3552.2	5744.6	135.10	22.55	41.64	443
260	10.856	3852.5	6155.4	136.72	22.41	40.55	444
270	10.362	4143.4	6556.0	138.23	22.30	39.59	446
280	9.9163	4426.4	6947.5	139.65	22.19	38.73	448
290	9.5112	4702.5	7331.0	141.00	22.10	37.98	451
300	9.1417	4972.6	7707.3	142.27	22.02	37.31	454
310	8.8033	5237.5	8077.3	143.49	21.96	36.71	458
320	8.4921	5497.8	8441.7	144.64	21.90	36.18	461
330	8.2050	5754.2	8801.1	145.75	21.85	35.71	465
340	7.9391	6007.1	9156.0	146.81	21.80	35.28	469
350	7.6920	6256.8	9506.9	147.83	21.76	34.90	473
360	7.4618	6503.9	9854.3	148.81	21.73	34.56	477
370	7.2467	6748.5	10198.	149.75	21.71	34.26	481
380	7.0452	6991.0	10539.	150.66	21.69	33.98	486
390	6.8560	7231.5	10878.	151.54	21.67	33.73	490
400	6.6779	7470.4	11214.	152.39	21.66	33.50	494
420	6.3510	7943.9	11880.	154.01	21.66	33.12	502
440	6.0582	8412.7	12539.	155.55	21.67	32.81	510
460	5.7938	8877.9	13193.	157.00	21.69	32.55	518
480	5.5538	9340.5	13842.	158.38	21.73	32.35	526
500	5.3348	9801.0	14487.	159.70	21.79	32.20	534
520	5.1339	10260.	15130.	160.96	21.85	32.08	541
540	4.9489	10719.	15771.	162.17	21.92	31.99	549
560	4.7778	11177.	16410.	163.33	22.01	31.93	556
580	4.6191	11635.	17048.	164.45	22.10	31.89	563
600	4.4713	12094.	17685.	165.53	22.20	31.88	570
620	4.3334	12554.	18323.	166.57	22.31	31.88	577
640	4.2043	13014.	18961.	167.59	22.42	31.90	584
660	4.0832	13476.	19599.	168.57	22.53	31.93	590
680	3.9692	13939.	20238.	169.52	22.65	31.97	597
700	3.8618	14404.	20878.	170.45	22.77	32.02	603
720	3.7604	14871.	21519.	171.35	22.90	32.08	609
740	3.6645	15339.	22161.	172.23	23.02	32.15	616
760	3.5736	15809.	22805.	173.09	23.15	32.22	622
780	3.4873	16281.	23450.	173.93	23.27	32.30	628
800	3.4053	16755.	24097.	174.75	23.40	32.38	634
850	3.2168	17950.	25721.	176.72	23.71	32.60	649
900	3.0489	19157.	27357.	178.59	24.02	32.82	663
950	2.8982	20378.	29004.	180.37	24.32	33.05	677
1000	2.7621	21611.	30662.	182.07	24.60	33.27	690
1050	2.6386	22856.	32331.	183.70	24.87	33.49	704
1100	2.5259	24114.	34011.	185.26	25.12	33.70	717

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1150	2.4227	25382.	35701.	186.76	25.36	33.91	729
1200	2.3277	26661.	37402.	188.21	25.58	34.10	742
			30.00 MPa Isobar				
* 69.44	31.798	-4140.4	-3196.9	69.04	33.32	53.46	1110
70	31.732	-4112.2	-3166.8	69.47	33.23	53.37	1105
72	31.499	-4012.7	-3060.3	70.97	32.90	53.10	1087
74	31.266	-3913.8	-2954.3	72.42	32.60	52.88	1069
76	31.033	-3815.5	-2848.7	73.83	32.30	52.70	1053
78	30.800	-3717.5	-2743.5	75.20	32.01	52.56	1037
80	30.566	-3620.0	-2638.5	76.53	31.74	52.43	1022
82	30.332	-3522.8	-2533.7	77.82	31.46	52.33	1007
84	30.098	-3425.9	-2429.1	79.08	31.20	52.25	993
86	29.863	-3329.3	-2324.7	80.31	30.95	52.17	979
88	29.628	-3233.0	-2220.4	81.51	30.70	52.11	966
90	29.392	-3137.0	-2116.3	82.68	30.46	52.06	953
92	29.155	-3041.2	-2012.2	83.82	30.22	52.00	940
94	28.919	-2945.7	-1908.3	84.94	29.99	51.96	927
96	28.681	-2850.4	-1804.4	86.03	29.76	51.91	915
98	28.443	-2755.3	-1700.6	87.10	29.54	51.87	903
100	28.205	-2660.5	-1596.9	88.15	29.33	51.83	891
102	27.966	-2566.0	-1493.3	89.18	29.12	51.79	879
104	27.727	-2471.7	-1389.7	90.18	28.92	51.75	867
106	27.487	-2377.7	-1286.3	91.17	28.72	51.71	856
108	27.247	-2283.9	-1182.9	92.13	28.53	51.67	845
110	27.007	-2190.4	-1079.6	93.08	28.34	51.63	834
112	26.766	-2097.2	-976.36	94.01	28.16	51.59	823
114	26.526	-2004.2	-873.23	94.93	27.98	51.54	812
116	26.285	-1911.5	-770.19	95.82	27.81	51.50	801
118	26.044	-1819.1	-667.23	96.70	27.64	51.46	791
120	25.803	-1727.0	-564.36	97.57	27.48	51.41	781
122	25.561	-1635.2	-461.58	98.42	27.32	51.37	771
124	25.320	-1543.7	-358.89	99.25	27.17	51.32	761
126	25.079	-1452.5	-256.30	100.07	27.02	51.27	751
128	24.838	-1361.6	-153.80	100.88	26.87	51.23	741
130	24.597	-1271.1	-51.39	101.67	26.73	51.18	732
132	24.356	-1180.8	50.92	102.45	26.60	51.13	722
134	24.115	-1090.9	153.14	103.22	26.47	51.08	713
136	23.874	-1001.3	255.25	103.98	26.34	51.03	704
138	23.634	-912.09	357.26	104.72	26.21	50.98	695
140	23.394	-823.20	459.16	105.46	26.09	50.92	686
142	23.155	-734.66	560.96	106.18	25.98	50.87	678

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
144	22.916	-646.48	662.64	106.89	25.86	50.81	670
146	22.678	-558.67	764.20	107.59	25.75	50.75	661
148	22.440	-471.25	865.64	108.28	25.65	50.69	653
150	22.203	-384.20	966.96	108.96	25.54	50.62	646
155	21.614	-168.33	1219.6	110.62	25.30	50.44	627
160	21.032	44.93	1471.3	112.21	25.07	50.23	609
165	20.457	255.45	1721.9	113.76	24.86	49.99	593
170	19.892	463.07	1971.2	115.24	24.67	49.72	578
175	19.338	667.66	2219.0	116.68	24.49	49.40	565
180	18.796	869.07	2465.1	118.07	24.32	49.04	552
185	18.269	1067.2	2709.4	119.41	24.16	48.65	541
190	17.756	1262.0	2951.5	120.70	24.01	48.22	532
195	17.260	1453.3	3191.5	121.94	23.87	47.75	523
200	16.780	1641.2	3429.0	123.15	23.73	47.25	515
210	15.875	2006.5	3896.3	125.43	23.49	46.19	503
220	15.041	2358.2	4352.7	127.55	23.26	45.08	494
230	14.279	2696.8	4797.9	129.53	23.06	43.96	488
240	13.583	3023.4	5232.0	131.38	22.89	42.87	483
250	12.950	3338.9	5655.4	133.11	22.73	41.84	481
260	12.374	3644.6	6069.0	134.73	22.59	40.88	480
270	11.849	3941.4	6473.3	136.25	22.47	40.00	480
280	11.368	4230.4	6869.3	137.70	22.36	39.21	480
290	10.929	4512.6	7257.7	139.06	22.26	38.49	482
300	10.524	4788.6	7639.2	140.35	22.18	37.84	484
310	10.151	5059.4	8014.6	141.58	22.11	37.25	486
320	9.8068	5325.3	8384.4	142.76	22.04	36.72	489
330	9.4874	5587.1	8749.2	143.88	21.99	36.25	491
340	9.1903	5845.2	9109.5	144.95	21.94	35.82	494
350	8.9134	6100.0	9465.7	145.99	21.90	35.43	498
360	8.6546	6351.8	9818.1	146.98	21.86	35.07	501
370	8.4121	6600.9	10167.	147.94	21.83	34.75	505
380	8.1844	6847.8	10513.	148.86	21.81	34.46	508
390	7.9700	7092.5	10857.	149.75	21.79	34.20	512
400	7.7680	7335.4	11197.	150.61	21.78	33.96	515
420	7.3963	7816.4	11872.	152.26	21.77	33.55	523
440	7.0623	8292.0	12540.	153.81	21.77	33.21	530
460	6.7601	8763.6	13201.	155.28	21.79	32.93	537
480	6.4853	9231.9	13858.	156.68	21.83	32.71	544
500	6.2341	9697.8	14510.	158.01	21.87	32.53	552
520	6.0034	10162.	15159.	159.29	21.93	32.39	559
540	5.7907	10625.	15806.	160.51	22.01	32.29	566
560	5.5938	11088.	16451.	161.68	22.09	32.21	572
580	5.4110	11550.	17094.	162.81	22.17	32.16	579
600	5.2407	12013.	17737.	163.90	22.27	32.13	586
620	5.0815	12476.	18380.	164.95	22.37	32.11	592

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
640	4.9325	12940.	19022.	165.97	22.48	32.12	599
660	4.7925	13405.	19664.	166.96	22.60	32.14	605
680	4.6608	13871.	20308.	167.92	22.71	32.17	612
700	4.5366	14339.	20951.	168.85	22.83	32.21	618
720	4.4193	14808.	21596.	169.76	22.95	32.26	624
740	4.3082	15279.	22242.	170.64	23.08	32.32	630
760	4.2029	15751.	22889.	171.51	23.20	32.39	636
780	4.1029	16226.	23537.	172.35	23.33	32.46	642
800	4.0077	16702.	24187.	173.17	23.45	32.53	647
850	3.7890	17901.	25819.	175.15	23.76	32.73	662
900	3.5939	19113.	27460.	177.03	24.07	32.94	676
950	3.4187	20337.	29113.	178.81	24.36	33.15	689
1000	3.2603	21574.	30776.	180.52	24.64	33.37	702
1050	3.1164	22823.	32450.	182.15	24.90	33.58	715
1100	2.9850	24083.	34134.	183.72	25.16	33.78	728
1150	2.8645	25355.	35828.	185.23	25.39	33.98	741
1200	2.7536	26637.	37531.	186.68	25.62	34.17	753
			40.00 MPa Isobar				
* 71.43	32.022	-4104.6	-2855.4	69.44	33.73	52.70	1136
72	31.960	-4077.1	-2825.5	69.86	33.62	52.61	1132
74	31.743	-3980.7	-2720.6	71.29	33.28	52.32	1116
76	31.527	-3884.9	-2616.2	72.69	32.95	52.09	1100
78	31.311	-3789.7	-2512.2	74.04	32.64	51.88	1086
80	31.095	-3695.0	-2408.6	75.35	32.34	51.71	1071
82	30.880	-3600.7	-2305.3	76.62	32.05	51.56	1058
84	30.664	-3506.8	-2202.3	77.86	31.77	51.43	1045
86	30.448	-3413.3	-2099.6	79.07	31.50	51.31	1032
88	30.232	-3320.2	-1997.1	80.25	31.24	51.20	1019
90	30.016	-3227.4	-1894.8	81.40	30.99	51.10	1007
92	29.799	-3135.0	-1792.7	82.52	30.74	51.01	995
94	29.583	-3042.9	-1690.7	83.62	30.50	50.92	984
96	29.367	-2951.1	-1589.0	84.69	30.27	50.84	973
98	29.150	-2859.6	-1487.4	85.74	30.05	50.76	962
100	28.934	-2768.4	-1385.9	86.76	29.83	50.67	951
102	28.718	-2677.6	-1284.7	87.76	29.62	50.59	940
104	28.501	-2587.0	-1183.6	88.75	29.42	50.51	930
106	28.285	-2496.8	-1082.6	89.71	29.22	50.43	919
108	28.069	-2406.9	-981.86	90.65	29.02	50.35	909
110	27.853	-2317.4	-881.25	91.57	28.83	50.26	899
112	27.638	-2228.1	-780.81	92.48	28.65	50.18	890
114	27.422	-2139.2	-680.55	93.36	28.47	50.09	880

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
116	27.208	-2050.6	-580.47	94.24	28.30	50.00	871
118	26.993	-1962.4	-480.56	95.09	28.13	49.91	861
120	26.779	-1874.6	-380.83	95.93	27.96	49.82	852
122	26.565	-1787.0	-281.29	96.75	27.80	49.72	843
124	26.352	-1699.9	-181.94	97.56	27.65	49.63	834
126	26.139	-1613.0	-82.78	98.35	27.49	49.53	826
128	25.927	-1526.6	16.19	99.13	27.35	49.44	817
130	25.716	-1440.5	114.97	99.90	27.21	49.34	809
132	25.505	-1354.8	213.54	100.65	27.07	49.24	800
134	25.295	-1269.4	311.92	101.39	26.93	49.14	792
136	25.086	-1184.5	410.10	102.12	26.80	49.04	784
138	24.877	-1099.9	508.06	102.83	26.67	48.93	777
140	24.669	-1015.6	605.83	103.53	26.55	48.83	769
142	24.462	-931.80	703.40	104.23	26.43	48.73	761
144	24.256	-848.33	800.74	104.91	26.31	48.62	754
146	24.051	-765.26	897.89	105.58	26.20	48.52	747
148	23.846	-682.58	994.82	106.24	26.09	48.41	740
150	23.643	-600.29	1091.5	106.89	25.98	48.31	733
155	23.139	-396.27	1332.4	108.46	25.73	48.04	716
160	22.642	-194.72	1571.9	109.99	25.49	47.76	700
165	22.153	4.32	1810.0	111.45	25.27	47.47	685
170	21.671	200.85	2046.6	112.86	25.06	47.18	671
175	21.198	394.84	2281.8	114.23	24.87	46.88	658
180	20.735	586.27	2515.4	115.54	24.69	46.57	646
185	20.280	775.13	2747.5	116.82	24.52	46.25	635
190	19.836	961.43	2977.9	118.04	24.37	45.93	624
195	19.403	1145.2	3206.7	119.23	24.22	45.59	615
200	18.980	1326.3	3433.8	120.38	24.08	45.24	606
210	18.169	1681.1	3882.6	122.57	23.83	44.52	591
220	17.404	2025.9	4324.2	124.63	23.60	43.78	579
230	16.686	2361.0	4758.3	126.56	23.40	43.03	569
240	16.014	2687.1	5184.8	128.37	23.22	42.28	561
250	15.387	3004.4	5604.0	130.08	23.06	41.54	555
260	14.804	3313.7	6015.8	131.70	22.91	40.83	550
270	14.260	3615.6	6420.6	133.23	22.78	40.14	547
280	13.754	3910.5	6818.7	134.67	22.66	39.49	545
290	13.283	4199.3	7210.6	136.05	22.56	38.89	544
300	12.844	4482.3	7596.6	137.36	22.47	38.32	543
310	12.434	4760.2	7977.1	138.61	22.39	37.79	543
320	12.051	5033.4	8352.6	139.80	22.31	37.31	544
330	11.692	5302.4	8723.4	140.94	22.25	36.86	545
340	11.356	5567.6	9090.0	142.03	22.19	36.45	546
350	11.040	5829.4	9452.6	143.08	22.15	36.07	548
360	10.743	6088.1	9811.6	144.10	22.10	35.73	550
370	10.462	6344.0	10167.	145.07	22.07	35.41	552

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
380	10.197	6597.3	10520.	146.01	22.04	35.12	554
390	9.9471	6848.4	10870.	146.92	22.01	34.85	557
400	9.7099	7097.4	11217.	147.80	21.99	34.60	559
420	9.2710	7590.0	11904.	149.48	21.97	34.17	565
440	8.8737	8076.5	12584.	151.06	21.96	33.81	570
460	8.5123	8558.2	13257.	152.55	21.98	33.51	576
480	8.1819	9036.1	13925.	153.97	22.00	33.26	582
500	7.8786	9511.0	14588.	155.33	22.04	33.06	588
520	7.5990	9983.6	15247.	156.62	22.10	32.89	594
540	7.3403	10455.	15904.	157.86	22.16	32.76	600
560	7.1002	10925.	16558.	159.05	22.23	32.66	606
580	6.8767	11394.	17211.	160.19	22.32	32.59	612
600	6.6679	11863.	17862.	161.30	22.41	32.54	618
620	6.4725	12332.	18512.	162.36	22.51	32.51	624
640	6.2891	12802.	19162.	163.40	22.61	32.50	630
660	6.1165	13273.	19812.	164.40	22.72	32.50	636
680	5.9539	13744.	20462.	165.37	22.83	32.51	641
700	5.8003	14217.	21113.	166.31	22.95	32.54	647
720	5.6550	14691.	21764.	167.23	23.07	32.58	653
740	5.5172	15166.	22416.	168.12	23.19	32.62	658
760	5.3865	15643.	23069.	168.99	23.31	32.67	664
780	5.2621	16121.	23723.	169.84	23.43	32.73	669
800	5.1438	16602.	24378.	170.67	23.55	32.79	675
850	4.8711	17810.	26022.	172.66	23.86	32.96	688
900	4.6272	19030.	27675.	174.55	24.15	33.15	701
950	4.4077	20262.	29337.	176.35	24.44	33.35	714
1000	4.2089	21506.	31009.	178.06	24.72	33.54	726
1050	4.0279	22761.	32691.	179.71	24.98	33.74	739
1100	3.8624	24027.	34383.	181.28	25.23	33.93	751
1150	3.7103	25303.	36084.	182.79	25.46	34.11	763
1200	3.5702	26590.	37794.	184.25	25.68	34.29	775
			50.00 MPa Isobar				
* 73.38	32.234	-4066.6	-2515.5	69.84	34.01	52.01	1163
74	32.172	-4037.7	-2483.5	70.27	33.90	51.91	1158
76	31.969	-3944.0	-2380.0	71.65	33.54	51.63	1144
78	31.767	-3850.9	-2276.9	72.99	33.20	51.39	1130
80	31.566	-3758.4	-2174.4	74.29	32.88	51.17	1117
82	31.364	-3666.4	-2072.2	75.55	32.57	50.99	1104
84	31.163	-3574.9	-1970.4	76.77	32.27	50.82	1092
86	30.962	-3483.8	-1868.9	77.97	31.99	50.67	1080
88	30.761	-3393.2	-1767.7	79.13	31.72	50.53	1068

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
90	30.560	-3302.9	-1666.8	80.27	31.46	50.41	1057
92	30.360	-3213.0	-1566.1	81.37	31.20	50.29	1046
94	30.159	-3123.5	-1465.6	82.45	30.96	50.18	1035
96	29.959	-3034.3	-1365.4	83.51	30.72	50.07	1024
98	29.759	-2945.5	-1265.3	84.54	30.50	49.96	1014
100	29.559	-2857.1	-1165.5	85.55	30.27	49.86	1004
102	29.359	-2769.0	-1065.9	86.53	30.06	49.76	994
104	29.160	-2681.2	-966.50	87.50	29.85	49.65	984
106	28.961	-2593.8	-867.30	88.44	29.65	49.55	975
108	28.762	-2506.7	-768.29	89.37	29.45	49.45	966
110	28.564	-2420.0	-669.50	90.28	29.26	49.34	956
112	28.366	-2333.6	-570.92	91.16	29.08	49.24	947
114	28.169	-2247.6	-472.55	92.03	28.90	49.13	939
116	27.972	-2161.9	-374.40	92.89	28.72	49.02	930
118	27.776	-2076.6	-276.46	93.73	28.55	48.91	921
120	27.580	-1991.6	-178.74	94.55	28.39	48.80	913
122	27.385	-1907.0	-81.25	95.35	28.22	48.69	905
124	27.191	-1822.8	16.02	96.14	28.07	48.58	897
126	26.998	-1739.0	113.05	96.92	27.92	48.46	889
128	26.805	-1655.5	209.86	97.68	27.77	48.34	881
130	26.613	-1572.3	306.43	98.43	27.62	48.23	873
132	26.422	-1489.6	402.77	99.17	27.48	48.11	866
134	26.232	-1407.2	498.87	99.89	27.35	47.99	858
136	26.042	-1325.2	594.73	100.60	27.22	47.87	851
138	25.854	-1243.6	690.35	101.30	27.09	47.75	844
140	25.666	-1162.4	785.73	101.98	26.96	47.63	837
142	25.479	-1081.5	880.86	102.66	26.84	47.51	830
144	25.294	-1001.0	975.76	103.32	26.72	47.39	823
146	25.109	-920.90	1070.4	103.97	26.61	47.26	817
148	24.925	-841.17	1164.8	104.62	26.50	47.14	810
150	24.743	-761.82	1259.0	105.25	26.39	47.02	804
155	24.291	-565.08	1493.3	106.78	26.13	46.71	788
160	23.846	-370.70	1726.1	108.26	25.88	46.41	774
165	23.408	-178.65	1957.4	109.69	25.66	46.10	760
170	22.977	11.07	2187.1	111.06	25.45	45.80	747
175	22.555	198.50	2415.3	112.38	25.25	45.49	734
180	22.140	383.64	2642.1	113.66	25.06	45.19	723
185	21.733	566.55	2867.2	114.89	24.89	44.89	712
190	21.334	747.23	3090.9	116.09	24.72	44.59	701
195	20.944	925.71	3313.1	117.24	24.57	44.28	692
200	20.562	1102.0	3533.8	118.36	24.43	43.98	683
210	19.824	1448.3	3970.6	120.49	24.16	43.38	667
220	19.121	1786.5	4401.4	122.49	23.93	42.78	653
230	18.453	2116.7	4826.2	124.38	23.72	42.19	641
240	17.821	2439.4	5245.1	126.16	23.53	41.60	631

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
250	17.222	2755.0	5658.2	127.85	23.36	41.02	623
260	16.657	3063.9	6065.6	129.45	23.21	40.46	616
270	16.123	3366.4	6467.4	130.96	23.07	39.91	611
280	15.621	3663.0	6863.9	132.41	22.95	39.39	607
290	15.146	3954.1	7255.2	133.78	22.84	38.88	603
300	14.699	4240.1	7641.6	135.09	22.74	38.40	601
310	14.278	4521.5	8023.4	136.34	22.65	37.95	599
320	13.880	4798.5	8400.7	137.54	22.57	37.52	598
330	13.505	5071.5	8773.9	138.69	22.50	37.12	598
340	13.150	5340.9	9143.3	139.79	22.43	36.75	598
350	12.814	5606.9	9509.0	140.85	22.38	36.40	598
360	12.495	5869.9	9871.4	141.87	22.33	36.08	599
370	12.194	6130.1	10231.	142.86	22.29	35.77	599
380	11.907	6387.7	10587.	143.81	22.25	35.49	601
390	11.635	6643.1	10941.	144.73	22.22	35.24	602
400	11.376	6896.3	11292.	145.61	22.20	35.00	604
420	10.893	7397.1	11987.	147.31	22.16	34.57	607
440	10.453	7891.6	12675.	148.91	22.15	34.21	611
460	10.050	8380.9	13356.	150.42	22.15	33.90	616
480	9.6800	8866.1	14031.	151.86	22.17	33.65	620
500	9.3384	9347.8	14702.	153.23	22.20	33.43	625
520	9.0222	9827.1	15369.	154.54	22.25	33.26	630
540	8.7285	10304.	16033.	155.79	22.31	33.12	635
560	8.4550	10780.	16694.	156.99	22.38	33.01	640
580	8.1995	11255.	17353.	158.15	22.45	32.92	645
600	7.9603	11730.	18011.	159.26	22.54	32.86	650
620	7.7358	12204.	18668.	160.34	22.63	32.82	655
640	7.5246	12679.	19324.	161.38	22.73	32.79	661
660	7.3255	13154.	19980.	162.39	22.84	32.79	666
680	7.1375	13630.	20635.	163.37	22.95	32.79	671
700	6.9596	14107.	21291.	164.32	23.06	32.81	676
720	6.7910	14585.	21948.	165.25	23.17	32.83	681
740	6.6309	15064.	22605.	166.15	23.29	32.87	686
760	6.4787	15545.	23262.	167.02	23.41	32.91	691
780	6.3338	16027.	23921.	167.88	23.53	32.96	696
800	6.1957	16511.	24581.	168.71	23.65	33.01	701
850	5.8768	17727.	26235.	170.72	23.95	33.17	714
900	5.5909	18955.	27898.	172.62	24.24	33.34	726
950	5.3329	20193.	29569.	174.43	24.52	33.51	738
1000	5.0987	21443.	31249.	176.15	24.79	33.70	750
1050	4.8851	22703.	32939.	177.80	25.05	33.88	762
1100	4.6893	23975.	34637.	179.38	25.29	34.06	774
1150	4.5092	25256.	36344.	180.90	25.52	34.23	785
1200	4.3429	26547.	38060.	182.36	25.74	34.40	796

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
			60.00 MPa Isobar				
* 75.30	32.437	-4026.9	-2177.1	70.23	34.21	51.39	1190
76	32.370	-3994.7	-2141.2	70.70	34.07	51.28	1185
78	32.180	-3903.4	-2038.9	72.03	33.71	51.00	1172
80	31.990	-3812.7	-1937.1	73.32	33.37	50.76	1159
82	31.800	-3722.6	-1835.8	74.57	33.04	50.54	1147
84	31.611	-3633.0	-1734.9	75.79	32.73	50.35	1135
86	31.422	-3543.9	-1634.4	76.97	32.44	50.18	1124
88	31.234	-3455.2	-1534.2	78.12	32.15	50.02	1113
90	31.045	-3367.0	-1434.3	79.24	31.88	49.87	1102
92	30.857	-3279.2	-1334.7	80.34	31.62	49.74	1092
94	30.669	-3191.7	-1235.4	81.41	31.37	49.61	1081
96	30.482	-3104.7	-1136.3	82.45	31.13	49.48	1071
98	30.295	-3018.0	-1037.4	83.47	30.90	49.37	1062
100	30.108	-2931.7	-938.82	84.46	30.67	49.25	1052
102	29.921	-2845.7	-840.44	85.44	30.45	49.13	1043
104	29.735	-2760.1	-742.29	86.39	30.24	49.02	1034
106	29.549	-2674.9	-644.36	87.32	30.04	48.91	1025
108	29.364	-2590.0	-546.66	88.24	29.84	48.79	1016
110	29.179	-2505.4	-449.18	89.13	29.65	48.68	1008
112	28.995	-2421.2	-351.95	90.01	29.46	48.56	999
114	28.812	-2337.4	-254.94	90.87	29.28	48.45	991
116	28.629	-2253.9	-158.16	91.71	29.11	48.33	983
118	28.446	-2170.8	-61.61	92.53	28.93	48.21	975
120	28.265	-2088.1	34.70	93.34	28.77	48.09	967
122	28.084	-2005.7	130.78	94.14	28.61	47.97	959
124	27.904	-1923.6	226.60	94.91	28.45	47.85	952
126	27.725	-1842.0	322.18	95.68	28.30	47.73	944
128	27.546	-1760.7	417.52	96.43	28.15	47.61	937
130	27.368	-1679.7	512.61	97.17	28.01	47.48	930
132	27.191	-1599.1	607.44	97.89	27.86	47.36	923
134	27.015	-1518.9	702.03	98.60	27.73	47.23	916
136	26.840	-1439.1	796.37	99.30	27.60	47.10	909
138	26.666	-1359.6	890.45	99.99	27.47	46.98	902
140	26.493	-1280.5	984.28	100.66	27.34	46.85	896
142	26.321	-1201.7	1077.8	101.33	27.22	46.72	889
144	26.150	-1123.3	1171.2	101.98	27.10	46.59	883
146	25.979	-1045.3	1264.2	102.62	26.98	46.47	877
148	25.810	-967.64	1357.0	103.25	26.87	46.34	871
150	25.642	-890.34	1449.6	103.87	26.76	46.21	865
155	25.226	-698.67	1679.8	105.38	26.50	45.89	850
160	24.817	-509.24	1908.5	106.83	26.25	45.57	836

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
165	24.415	-322.00	2135.6	108.23	26.02	45.26	823
170	24.019	-136.94	2361.1	109.58	25.80	44.95	811
175	23.631	45.97	2585.1	110.88	25.60	44.64	799
180	23.249	226.79	2807.5	112.13	25.41	44.34	788
185	22.875	405.55	3028.5	113.34	25.23	44.04	777
190	22.509	582.28	3247.9	114.51	25.06	43.75	767
195	22.149	757.03	3466.0	115.65	24.91	43.46	758
200	21.797	929.84	3682.6	116.74	24.76	43.18	749
210	21.114	1269.8	4111.5	118.83	24.48	42.62	732
220	20.461	1602.6	4535.0	120.81	24.24	42.08	718
230	19.836	1928.4	4953.2	122.66	24.02	41.56	705
240	19.240	2247.7	5366.2	124.42	23.83	41.05	694
250	18.672	2560.8	5774.2	126.09	23.65	40.55	685
260	18.131	2868.0	6177.4	127.67	23.49	40.08	677
270	17.616	3169.7	6575.8	129.17	23.35	39.61	670
280	17.126	3466.2	6969.7	130.60	23.22	39.17	664
290	16.661	3757.8	7359.1	131.97	23.10	38.74	660
300	16.218	4044.9	7744.4	133.28	22.99	38.32	656
310	15.798	4327.7	8125.7	134.53	22.90	37.93	653
320	15.398	4606.5	8503.1	135.73	22.81	37.56	650
330	15.018	4881.7	8876.9	136.88	22.73	37.20	648
340	14.656	5153.4	9247.2	137.98	22.66	36.87	647
350	14.312	5422.0	9614.3	139.05	22.60	36.55	646
360	13.984	5687.6	9978.3	140.07	22.55	36.25	646
370	13.671	5950.6	10339.	141.06	22.50	35.97	646
380	13.373	6211.1	10698.	142.02	22.46	35.71	646
390	13.088	6469.4	11054.	142.94	22.42	35.47	646
400	12.816	6725.5	11407.	143.84	22.39	35.24	647
420	12.306	7232.2	12108.	145.55	22.35	34.83	649
440	11.838	7732.5	12801.	147.16	22.32	34.48	651
460	11.407	8227.5	13487.	148.68	22.32	34.18	654
480	11.009	8718.1	14168.	150.13	22.33	33.92	658
500	10.640	9205.3	14844.	151.51	22.36	33.71	661
520	10.297	9689.7	15517.	152.83	22.40	33.53	665
540	9.9767	10172.	16186.	154.09	22.45	33.39	669
560	9.6776	10653.	16852.	155.31	22.51	33.27	674
580	9.3975	11132.	17517.	156.47	22.59	33.18	678
600	9.1343	11611.	18180.	157.60	22.67	33.11	682
620	8.8867	12090.	18842.	158.68	22.76	33.06	687
640	8.6533	12569.	19503.	159.73	22.85	33.03	691
660	8.4327	13048.	20163.	160.75	22.95	33.02	696
680	8.2240	13528.	20823.	161.73	23.06	33.02	700
700	8.0261	14008.	21484.	162.69	23.17	33.03	705
720	7.8382	14490.	22144.	163.62	23.28	33.05	710
740	7.6595	14972.	22806.	164.53	23.39	33.07	714

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
760	7.4894	15456.	23467.	165.41	23.51	33.11	719
780	7.3272	15941.	24130.	166.27	23.62	33.15	723
800	7.1723	16428.	24794.	167.11	23.74	33.20	728
850	6.8140	17652.	26457.	169.13	24.03	33.34	740
900	6.4919	18886.	28128.	171.04	24.32	33.50	751
950	6.2004	20130.	29807.	172.85	24.60	33.66	762
1000	5.9353	21385.	31494.	174.58	24.86	33.83	774
1050	5.6929	22651.	33190.	176.24	25.12	34.01	785
1100	5.4704	23927.	34895.	177.82	25.36	34.17	796
1150	5.2654	25212.	36608.	179.35	25.59	34.34	807
1200	5.0757	26508.	38329.	180.81	25.80	34.50	818
			80.00 MPa Isobar				
* 78.98	32.820	-3945.4	-1507.9	70.96	34.43	50.31	1242
80	32.733	-3900.7	-1456.6	71.60	34.24	50.17	1236
82	32.562	-3813.4	-1356.6	72.84	33.89	49.91	1225
84	32.392	-3726.8	-1257.0	74.04	33.55	49.67	1214
86	32.222	-3640.6	-1157.9	75.20	33.23	49.46	1203
88	32.053	-3555.0	-1059.1	76.34	32.93	49.27	1193
90	31.883	-3469.9	-960.74	77.44	32.64	49.10	1183
92	31.715	-3385.2	-862.70	78.52	32.37	48.94	1174
94	31.546	-3300.9	-764.97	79.57	32.10	48.79	1164
96	31.379	-3217.1	-667.54	80.60	31.85	48.65	1155
98	31.211	-3133.6	-570.38	81.60	31.61	48.51	1146
100	31.044	-3050.5	-473.49	82.58	31.38	48.38	1138
102	30.877	-2967.8	-376.84	83.54	31.15	48.25	1129
104	30.711	-2885.4	-280.47	84.47	30.94	48.13	1121
106	30.545	-2803.4	-184.34	85.39	30.73	48.01	1113
108	30.380	-2721.8	-88.45	86.28	30.53	47.89	1105
110	30.215	-2640.5	7.20	87.16	30.33	47.77	1097
112	30.051	-2559.5	102.61	88.02	30.15	47.64	1089
114	29.888	-2478.9	197.78	88.86	29.96	47.52	1082
116	29.725	-2398.6	292.71	89.69	29.79	47.40	1074
118	29.563	-2318.7	387.40	90.50	29.61	47.28	1067
120	29.401	-2239.1	481.84	91.29	29.45	47.16	1060
122	29.240	-2159.9	576.06	92.07	29.28	47.04	1053
124	29.080	-2081.0	670.00	92.83	29.13	46.92	1046
126	28.921	-2002.5	763.72	93.58	28.97	46.79	1040
128	28.763	-1924.2	857.16	94.32	28.83	46.67	1033
130	28.605	-1846.4	950.37	95.04	28.68	46.54	1026
132	28.448	-1768.8	1043.3	95.75	28.54	46.42	1020
134	28.292	-1691.6	1136.0	96.45	28.40	46.29	1014

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
136	28.137	-1614.8	1228.5	97.13	28.27	46.16	1008
138	27.983	-1538.2	1320.7	97.81	28.14	46.03	1002
140	27.829	-1462.0	1412.6	98.47	28.01	45.91	996
142	27.677	-1386.2	1504.3	99.12	27.89	45.78	990
144	27.526	-1310.7	1595.7	99.76	27.77	45.65	984
146	27.375	-1235.5	1686.9	100.39	27.65	45.52	978
148	27.225	-1160.6	1777.8	101.00	27.54	45.39	973
150	27.077	-1086.1	1868.5	101.61	27.43	45.26	967
155	26.709	-901.24	2094.0	103.09	27.16	44.94	954
160	26.348	-718.38	2317.9	104.51	26.91	44.63	941
165	25.993	-537.53	2540.3	105.88	26.68	44.31	929
170	25.644	-358.61	2761.1	107.20	26.46	44.01	918
175	25.301	-181.61	2980.3	108.47	26.25	43.70	907
180	24.964	-6.47	3198.1	109.70	26.05	43.40	896
185	24.634	166.84	3414.4	110.88	25.87	43.11	886
190	24.310	338.37	3629.2	112.03	25.69	42.83	877
195	23.992	508.18	3842.7	113.14	25.53	42.55	868
200	23.680	676.30	4054.8	114.21	25.37	42.28	859
210	23.073	1007.7	4474.9	116.26	25.08	41.76	843
220	22.490	1332.8	4890.0	118.19	24.83	41.26	828
230	21.930	1652.2	5300.2	120.02	24.59	40.79	815
240	21.391	1966.0	5705.9	121.74	24.38	40.34	803
250	20.874	2274.6	6107.2	123.38	24.19	39.92	793
260	20.377	2578.3	6504.3	124.94	24.02	39.51	783
270	19.900	2877.4	6897.5	126.42	23.86	39.13	775
280	19.443	3172.2	7286.9	127.84	23.72	38.76	768
290	19.003	3462.9	7672.7	129.19	23.59	38.40	761
300	18.582	3749.7	8055.0	130.49	23.47	38.07	755
310	18.177	4033.0	8434.1	131.73	23.36	37.75	750
320	17.789	4312.8	8810.0	132.93	23.27	37.44	746
330	17.416	4589.5	9182.9	134.07	23.18	37.15	742
340	17.058	4863.2	9553.0	135.18	23.10	36.87	739
350	16.715	5134.1	9920.4	136.24	23.02	36.61	736
360	16.384	5402.5	10285.	137.27	22.96	36.36	734
370	16.067	5668.4	10648.	138.26	22.90	36.12	732
380	15.762	5932.0	11008.	139.22	22.85	35.89	731
390	15.468	6193.6	11365.	140.15	22.80	35.68	730
400	15.186	6453.2	11721.	141.05	22.76	35.48	729
420	14.652	6967.1	12427.	142.78	22.70	35.12	728
440	14.156	7474.8	13126.	144.40	22.66	34.80	728
460	13.694	7977.4	13819.	145.94	22.64	34.52	729
480	13.264	8475.6	14507.	147.41	22.64	34.28	730
500	12.861	8970.3	15190.	148.80	22.65	34.07	732
520	12.484	9462.1	15870.	150.13	22.68	33.90	734
540	12.130	9951.6	16547.	151.41	22.72	33.76	736

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
560	11.797	10439.	17221.	152.64	22.77	33.64	739
580	11.483	10926.	17893.	153.82	22.84	33.55	741
600	11.187	11412.	18563.	154.95	22.91	33.48	744
620	10.907	11897.	19232.	156.05	22.99	33.42	748
640	10.641	12382.	19900.	157.11	23.08	33.39	751
660	10.390	12867.	20567.	158.14	23.17	33.37	754
680	10.150	13353.	21234.	159.13	23.27	33.36	758
700	9.9226	13839.	21902.	160.10	23.37	33.36	761
720	9.7056	14326.	22569.	161.04	23.48	33.37	765
740	9.4987	14814.	23237.	161.95	23.59	33.39	769
760	9.3010	15303.	23905.	162.84	23.70	33.42	773
780	9.1119	15794.	24574.	163.71	23.81	33.46	776
800	8.9309	16285.	25243.	164.56	23.92	33.50	780
850	8.5104	17521.	26921.	166.59	24.20	33.62	790
900	8.1301	18765.	28605.	168.52	24.48	33.76	800
950	7.7843	20020.	30297.	170.35	24.75	33.91	810
1000	7.4683	21284.	31996.	172.09	25.01	34.07	819
1050	7.1783	22559.	33704.	173.76	25.25	34.22	829
1100	6.9110	23843.	35419.	175.35	25.49	34.38	839
1150	6.6639	25136.	37141.	176.89	25.71	34.53	849
1200	6.4346	26439.	38871.	178.36	25.92	34.67	859
100.00 MPa Isobar							
* 82.57	33.170	-3858.5	-843.67	71.68	34.53	49.39	1291
84	33.059	-3798.3	-773.35	72.52	34.27	49.21	1284
86	32.904	-3714.4	-675.18	73.68	33.93	48.97	1274
88	32.749	-3631.0	-577.45	74.80	33.61	48.76	1265
90	32.594	-3548.2	-480.14	75.89	33.31	48.56	1255
92	32.440	-3465.8	-383.19	76.96	33.02	48.38	1246
94	32.287	-3383.8	-286.57	78.00	32.75	48.22	1237
96	32.133	-3302.3	-190.31	79.01	32.49	48.07	1229
98	31.980	-3221.2	-94.32	80.00	32.24	47.92	1221
100	31.828	-3140.5	1.39	80.97	32.00	47.78	1212
102	31.676	-3060.2	96.82	81.91	31.77	47.65	1205
104	31.524	-2980.2	191.99	82.84	31.55	47.52	1197
106	31.373	-2900.5	286.91	83.74	31.34	47.40	1189
108	31.222	-2821.2	381.58	84.62	31.13	47.27	1182
110	31.072	-2742.3	476.03	85.49	30.94	47.15	1174
112	30.923	-2663.7	570.19	86.34	30.75	47.03	1167
114	30.774	-2585.4	664.14	87.17	30.56	46.92	1160
116	30.625	-2507.4	757.86	87.99	30.38	46.80	1153
118	30.477	-2429.8	851.34	88.78	30.21	46.68	1147

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
120	30.330	-2352.5	944.59	89.57	30.04	46.56	1140
122	30.184	-2275.5	1037.6	90.34	29.88	46.44	1133
124	30.038	-2198.8	1130.4	91.09	29.72	46.32	1127
126	29.893	-2122.4	1222.9	91.83	29.57	46.21	1121
128	29.748	-2046.4	1315.2	92.56	29.42	46.09	1114
130	29.605	-1970.6	1407.2	93.27	29.27	45.97	1108
132	29.462	-1895.2	1499.1	93.97	29.13	45.85	1102
134	29.319	-1820.1	1590.6	94.66	29.00	45.72	1097
136	29.178	-1745.3	1681.9	95.34	28.86	45.60	1091
138	29.038	-1670.8	1773.0	96.00	28.73	45.48	1085
140	28.898	-1596.6	1863.9	96.66	28.60	45.36	1080
142	28.759	-1522.7	1954.4	97.30	28.48	45.23	1074
144	28.621	-1449.2	2044.8	97.93	28.36	45.11	1069
146	28.484	-1375.9	2134.9	98.55	28.24	44.99	1063
148	28.347	-1302.9	2224.7	99.16	28.13	44.87	1058
150	28.212	-1230.3	2314.4	99.76	28.02	44.74	1053
155	27.877	-1049.9	2537.3	101.23	27.75	44.44	1041
160	27.547	-871.42	2758.7	102.63	27.50	44.13	1029
165	27.223	-694.72	2978.6	103.99	27.26	43.83	1018
170	26.905	-519.80	3197.0	105.29	27.03	43.53	1007
175	26.592	-346.63	3413.9	106.55	26.82	43.23	996
180	26.285	-175.14	3629.3	107.76	26.62	42.94	986
185	25.983	-5.32	3843.4	108.93	26.43	42.66	977
190	25.687	162.90	4056.0	110.07	26.25	42.38	967
195	25.396	329.53	4267.2	111.17	26.09	42.11	959
200	25.110	494.65	4477.1	112.23	25.92	41.85	950
210	24.554	820.47	4893.1	114.26	25.63	41.34	934
220	24.019	1140.7	5304.1	116.17	25.36	40.87	920
230	23.503	1455.6	5710.5	117.98	25.11	40.41	907
240	23.005	1765.6	6112.5	119.69	24.89	39.99	895
250	22.526	2071.0	6510.3	121.31	24.69	39.58	884
260	22.064	2371.9	6904.2	122.86	24.51	39.20	874
270	21.619	2668.7	7294.4	124.33	24.34	38.84	865
280	21.189	2961.7	7681.0	125.74	24.19	38.50	857
290	20.775	3251.0	8064.4	127.08	24.04	38.18	849
300	20.376	3536.9	8444.7	128.37	23.92	37.87	843
310	19.991	3819.6	8822.0	129.61	23.80	37.58	837
320	19.619	4099.3	9196.4	130.80	23.69	37.31	831
330	19.260	4376.1	9568.2	131.94	23.59	37.05	826
340	18.914	4650.3	9937.4	133.04	23.50	36.80	822
350	18.579	4921.9	10304.	134.11	23.42	36.57	818
360	18.256	5191.2	10669.	135.13	23.34	36.34	815
370	17.944	5458.3	11031.	136.13	23.27	36.13	812
380	17.643	5723.3	11391.	137.09	23.21	35.93	809
390	17.351	5986.5	11750.	138.02	23.16	35.74	807

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
400	17.069	6247.8	12106.	138.92	23.11	35.57	805
420	16.532	6765.5	12814.	140.65	23.04	35.24	802
440	16.029	7277.5	13516.	142.28	22.98	34.95	800
460	15.557	7784.6	14213.	143.83	22.95	34.70	798
480	15.113	8287.5	14904.	145.30	22.93	34.48	798
500	14.695	8786.9	15592.	146.70	22.93	34.29	798
520	14.301	9283.6	16276.	148.04	22.95	34.13	798
540	13.929	9777.9	16957.	149.33	22.98	33.99	799
560	13.577	10271.	17636.	150.56	23.03	33.88	800
580	13.244	10762.	18313.	151.75	23.08	33.79	802
600	12.927	11252.	18988.	152.90	23.15	33.72	804
620	12.627	11742.	19662.	154.00	23.22	33.67	806
640	12.341	12232.	20335.	155.07	23.30	33.63	808
660	12.069	12722.	21007.	156.10	23.39	33.61	810
680	11.810	13212.	21679.	157.11	23.48	33.60	813
700	11.562	13702.	22351.	158.08	23.57	33.60	815
720	11.325	14194.	23024.	159.03	23.67	33.61	818
740	11.099	14686.	23696.	159.95	23.78	33.63	821
760	10.882	15179.	24369.	160.85	23.88	33.66	824
780	10.674	15673.	25042.	161.72	23.99	33.69	827
800	10.474	16169.	25716.	162.57	24.10	33.72	830
850	10.008	17413.	27405.	164.62	24.36	33.84	838
900	9.5843	18667.	29100.	166.56	24.63	33.97	846
950	9.1973	19929.	30802.	168.40	24.89	34.11	855
1000	8.8421	21201.	32511.	170.15	25.14	34.25	864
1050	8.5148	22483.	34227.	171.83	25.38	34.40	873
1100	8.2122	23774.	35951.	173.43	25.61	34.54	881
1150	7.9314	25073.	37681.	174.97	25.83	34.69	890
1200	7.6702	26382.	39419.	176.45	26.03	34.82	899
			150.00 MPa Isobar				
* 91.02	33.953	-3634.5	783.40	73.26	34.57	47.60	1402
92	33.890	-3595.9	830.18	73.77	34.42	47.50	1398
94	33.762	-3517.9	925.00	74.79	34.12	47.31	1390
96	33.634	-3440.3	1019.5	75.79	33.84	47.14	1383
98	33.506	-3363.2	1113.6	76.76	33.57	46.98	1375
100	33.379	-3286.5	1207.4	77.71	33.31	46.83	1368
102	33.252	-3210.1	1300.9	78.63	33.07	46.69	1361
104	33.126	-3134.1	1394.1	79.54	32.84	46.56	1354
106	32.999	-3058.4	1487.1	80.42	32.62	46.43	1347
108	32.873	-2983.1	1579.9	81.29	32.41	46.31	1340
110	32.748	-2908.1	1672.4	82.14	32.21	46.20	1334

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
112	32.623	-2833.4	1764.7	82.97	32.01	46.09	1327
114	32.498	-2758.9	1856.7	83.78	31.82	45.98	1321
116	32.374	-2684.8	1948.6	84.58	31.64	45.87	1315
118	32.250	-2611.0	2040.2	85.37	31.46	45.77	1309
120	32.126	-2537.4	2131.6	86.14	31.30	45.66	1303
122	32.004	-2464.1	2222.9	86.89	31.13	45.56	1297
124	31.881	-2391.1	2313.9	87.63	30.97	45.46	1291
126	31.759	-2318.3	2404.7	88.36	30.82	45.36	1286
128	31.638	-2245.8	2495.3	89.07	30.67	45.25	1280
130	31.517	-2173.6	2585.7	89.77	30.52	45.15	1275
132	31.397	-2101.6	2675.9	90.46	30.38	45.05	1270
134	31.277	-2029.9	2765.9	91.14	30.24	44.95	1264
136	31.158	-1958.5	2855.7	91.80	30.11	44.84	1259
138	31.040	-1887.2	2945.3	92.45	29.98	44.74	1254
140	30.922	-1816.3	3034.7	93.10	29.85	44.64	1249
142	30.804	-1745.6	3123.8	93.73	29.73	44.53	1244
144	30.688	-1675.1	3212.8	94.35	29.61	44.43	1239
146	30.572	-1604.9	3301.6	94.96	29.49	44.32	1235
148	30.457	-1534.9	3390.1	95.57	29.37	44.22	1230
150	30.342	-1465.2	3478.4	96.16	29.26	44.11	1225
155	30.058	-1292.0	3698.3	97.60	28.99	43.85	1214
160	29.779	-1120.2	3916.9	98.99	28.74	43.58	1203
165	29.504	-949.96	4134.2	100.33	28.49	43.32	1193
170	29.233	-781.14	4350.1	101.62	28.27	43.05	1183
175	28.966	-613.74	4564.7	102.86	28.05	42.79	1174
180	28.704	-447.74	4778.0	104.06	27.84	42.53	1164
185	28.446	-283.09	4990.0	105.22	27.65	42.27	1156
190	28.193	-119.79	5200.8	106.35	27.46	42.02	1147
195	27.943	42.22	5410.2	107.44	27.28	41.77	1139
200	27.698	202.94	5618.5	108.49	27.11	41.53	1131
210	27.220	520.72	6031.4	110.50	26.80	41.05	1116
220	26.758	833.81	6439.6	112.40	26.51	40.60	1102
230	26.311	1142.4	6843.4	114.20	26.24	40.17	1089
240	25.879	1446.9	7243.0	115.90	26.00	39.76	1078
250	25.461	1747.4	7638.7	117.51	25.78	39.37	1066
260	25.057	2044.2	8030.6	119.05	25.57	39.01	1056
270	24.665	2337.5	8419.0	120.52	25.38	38.67	1047
280	24.286	2627.5	8804.0	121.92	25.21	38.34	1038
290	23.918	2914.4	9185.9	123.26	25.05	38.04	1029
300	23.562	3198.4	9564.7	124.54	24.90	37.75	1022
310	23.216	3479.7	9940.9	125.78	24.76	37.48	1015
320	22.880	3758.4	10314.	126.96	24.63	37.22	1008
330	22.554	4034.6	10685.	128.10	24.51	36.98	1002
340	22.238	4308.6	11054.	129.20	24.40	36.75	996
350	21.930	4580.4	11420.	130.27	24.30	36.54	991

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
360	21.631	4850.3	11785.	131.29	24.21	36.34	986
370	21.340	5118.2	12147.	132.29	24.12	36.15	981
380	21.057	5384.4	12508.	133.25	24.04	35.97	977
390	20.782	5649.0	12867.	134.18	23.97	35.81	973
400	20.514	5912.0	13224.	135.08	23.91	35.65	970
420	19.999	6433.7	13934.	136.82	23.80	35.37	963
440	19.510	6950.5	14639.	138.46	23.72	35.12	958
460	19.045	7463.0	15339.	140.01	23.66	34.90	953
480	18.603	7971.8	16035.	141.49	23.61	34.71	950
500	18.181	8477.5	16728.	142.91	23.59	34.55	946
520	17.780	8980.8	17417.	144.26	23.59	34.42	944
540	17.396	9482.0	18105.	145.56	23.59	34.31	942
560	17.030	9981.6	18790.	146.80	23.62	34.21	940
580	16.679	10480.	19473.	148.00	23.65	34.14	939
600	16.344	10978.	20155.	149.16	23.70	34.08	939
620	16.022	11475.	20837.	150.27	23.75	34.04	938
640	15.714	11972.	21517.	151.35	23.82	34.01	938
660	15.419	12469.	22197.	152.40	23.89	33.99	939
680	15.135	12966.	22877.	153.42	23.96	33.99	939
700	14.861	13463.	23557.	154.40	24.05	33.99	940
720	14.599	13962.	24236.	155.36	24.13	34.00	941
740	14.346	14461.	24917.	156.29	24.22	34.02	942
760	14.102	14961.	25597.	157.20	24.32	34.04	943
780	13.867	15461.	26278.	158.08	24.41	34.07	944
800	13.641	15963.	26960.	158.95	24.51	34.11	946
850	13.107	17224.	28668.	161.02	24.75	34.21	950
900	12.617	18492.	30381.	162.97	25.00	34.33	955
950	12.164	19770.	32101.	164.83	25.24	34.46	961
1000	11.745	21056.	33827.	166.61	25.47	34.59	967
1050	11.355	22350.	35560.	168.30	25.69	34.73	973
1100	10.992	23654.	37300.	169.91	25.91	34.86	980
1150	10.653	24965.	39046.	171.47	26.11	34.99	987
1200	10.335	26285.	40799.	172.96	26.30	35.12	994
			200.00 MPa Isobar				
* 98.98	34.632	-3399.9	2375.2	74.67	34.53	46.29	1498
100	34.576	-3362.1	2422.3	75.15	34.40	46.21	1494
102	34.466	-3288.3	2514.6	76.06	34.14	46.07	1488
104	34.356	-3214.9	2606.6	76.95	33.90	45.93	1481
106	34.246	-3141.8	2698.3	77.83	33.67	45.81	1475
108	34.137	-3069.0	2789.8	78.68	33.45	45.69	1469
110	34.028	-2996.5	2881.1	79.52	33.24	45.58	1462

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
112	33.919	-2924.3	2972.1	80.34	33.04	45.48	1456
114	33.810	-2852.4	3063.0	81.15	32.85	45.38	1451
116	33.702	-2780.8	3153.7	81.93	32.66	45.28	1445
118	33.593	-2709.4	3244.1	82.71	32.49	45.19	1439
120	33.486	-2638.3	3334.4	83.47	32.32	45.10	1434
122	33.378	-2567.4	3424.5	84.21	32.15	45.01	1428
124	33.271	-2496.8	3514.5	84.94	31.99	44.92	1423
126	33.164	-2426.3	3604.2	85.66	31.84	44.84	1418
128	33.058	-2356.2	3693.8	86.37	31.69	44.75	1413
130	32.952	-2286.2	3783.2	87.06	31.54	44.67	1408
132	32.846	-2216.5	3872.5	87.74	31.40	44.58	1403
134	32.741	-2146.9	3961.6	88.41	31.26	44.50	1398
136	32.636	-2077.6	4050.5	89.07	31.13	44.41	1393
138	32.532	-2008.5	4139.2	89.72	31.00	44.33	1388
140	32.428	-1939.7	4227.8	90.35	30.87	44.24	1384
142	32.325	-1871.0	4316.2	90.98	30.75	44.16	1379
144	32.222	-1802.5	4404.4	91.60	30.63	44.07	1375
146	32.120	-1734.3	4492.5	92.20	30.51	43.98	1370
148	32.018	-1666.2	4580.3	92.80	30.39	43.90	1366
150	31.916	-1598.3	4668.1	93.39	30.28	43.81	1361
155	31.665	-1429.6	4886.6	94.82	30.01	43.59	1351
160	31.417	-1262.1	5103.9	96.20	29.76	43.36	1341
165	31.172	-1095.8	5320.2	97.53	29.51	43.14	1331
170	30.931	-930.75	5535.3	98.82	29.28	42.91	1322
175	30.693	-766.88	5749.3	100.06	29.06	42.68	1313
180	30.459	-604.18	5962.1	101.26	28.85	42.45	1304
185	30.228	-442.64	6173.7	102.42	28.65	42.22	1296
190	30.001	-282.23	6384.3	103.54	28.46	42.00	1288
195	29.777	-122.94	6593.7	104.63	28.28	41.77	1280
200	29.556	35.26	6802.0	105.68	28.10	41.55	1273
210	29.126	348.49	7215.3	107.70	27.78	41.11	1258
220	28.708	657.62	7624.2	109.60	27.47	40.68	1245
230	28.304	962.86	8029.0	111.40	27.20	40.28	1232
240	27.912	1264.4	8429.8	113.11	26.94	39.88	1221
250	27.532	1562.4	8826.8	114.73	26.70	39.51	1210
260	27.163	1857.1	9220.1	116.27	26.48	39.15	1200
270	26.805	2148.6	9609.9	117.74	26.27	38.81	1190
280	26.458	2437.2	9996.4	119.15	26.08	38.49	1181
290	26.121	2723.0	10380.	120.49	25.91	38.19	1173
300	25.793	3006.1	10760.	121.78	25.74	37.90	1165
310	25.474	3286.7	11138.	123.02	25.59	37.63	1157
320	25.164	3564.9	11513.	124.21	25.44	37.37	1150
330	24.862	3840.9	11885.	125.36	25.31	37.13	1144
340	24.568	4114.8	12255.	126.46	25.19	36.90	1137
350	24.282	4386.8	12623.	127.53	25.07	36.69	1131

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
360	24.003	4656.9	12989.	128.56	24.96	36.48	1126
370	23.731	4925.3	13353.	129.56	24.87	36.29	1121
380	23.465	5192.0	13715.	130.52	24.78	36.12	1116
390	23.207	5457.2	14076.	131.46	24.69	35.95	1111
400	22.954	5721.0	14434.	132.37	24.62	35.79	1107
420	22.466	6244.7	15147.	134.11	24.48	35.51	1099
440	22.000	6763.8	15855.	135.75	24.38	35.26	1092
460	21.554	7279.0	16558.	137.32	24.29	35.05	1085
480	21.127	7790.7	17257.	138.80	24.23	34.87	1080
500	20.718	8299.7	17953.	140.22	24.19	34.72	1075
520	20.326	8806.4	18646.	141.58	24.16	34.59	1070
540	19.949	9311.2	19337.	142.89	24.15	34.48	1067
560	19.587	9814.6	20025.	144.14	24.16	34.40	1063
580	19.239	10317.	20713.	145.34	24.18	34.33	1060
600	18.903	10818.	21399.	146.51	24.21	34.28	1058
620	18.580	11320.	22084.	147.63	24.25	34.24	1056
640	18.269	11821.	22768.	148.72	24.30	34.22	1054
660	17.968	12322.	23453.	149.77	24.35	34.21	1053
680	17.678	12823.	24137.	150.79	24.42	34.20	1052
700	17.397	13325.	24821.	151.78	24.49	34.21	1051
720	17.126	13827.	25505.	152.75	24.56	34.23	1050
740	16.864	14331.	26190.	153.69	24.64	34.25	1050
760	16.611	14835.	26875.	154.60	24.72	34.27	1050
780	16.365	15340.	27561.	155.49	24.81	34.31	1050
800	16.127	15846.	28247.	156.36	24.89	34.34	1050
850	15.563	17116.	29967.	158.44	25.12	34.45	1051
900	15.040	18395.	31693.	160.42	25.34	34.57	1054
950	14.554	19682.	33424.	162.29	25.56	34.69	1057
1000	14.100	20977.	35162.	164.07	25.78	34.83	1061
1050	13.675	22281.	36907.	165.77	25.99	34.96	1065
1100	13.276	23593.	38658.	167.40	26.19	35.08	1069
1150	12.902	24913.	40415.	168.96	26.38	35.21	1074
1200	12.549	26241.	42178.	170.47	26.56	35.33	1080
			250.00 MPa Isobar				
* 106.38	35.247	-3165.4	3927.4	75.86	34.50	45.30	1582
108	35.168	-3107.9	4000.7	76.54	34.32	45.20	1577
110	35.071	-3037.3	4091.0	77.37	34.11	45.10	1572
112	34.975	-2966.9	4181.1	78.18	33.90	45.00	1566
114	34.878	-2896.8	4271.0	78.98	33.70	44.91	1560
116	34.781	-2827.0	4360.8	79.76	33.52	44.82	1555
118	34.685	-2757.4	4450.3	80.52	33.34	44.73	1550

Table 22. Thermodynamic properties of nitrogen–Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
120	34.589	-2688.1	4539.7	81.27	33.17	44.66	1544
122	34.493	-2619.0	4629.0	82.01	33.00	44.58	1539
124	34.397	-2550.1	4718.1	82.74	32.84	44.50	1534
126	34.301	-2481.4	4807.0	83.45	32.68	44.43	1529
128	34.206	-2412.9	4895.8	84.15	32.54	44.36	1524
130	34.111	-2344.6	4984.4	84.83	32.39	44.29	1519
132	34.016	-2276.5	5072.9	85.51	32.25	44.22	1515
134	33.922	-2208.6	5161.3	86.17	32.11	44.15	1510
136	33.828	-2140.9	5249.6	86.83	31.98	44.08	1506
138	33.734	-2073.4	5337.6	87.47	31.85	44.01	1501
140	33.640	-2006.0	5425.6	88.10	31.73	43.94	1497
142	33.547	-1938.9	5513.4	88.73	31.60	43.87	1492
144	33.454	-1871.9	5601.0	89.34	31.48	43.80	1488
146	33.362	-1805.1	5688.6	89.94	31.37	43.73	1484
148	33.270	-1738.4	5776.0	90.54	31.25	43.66	1480
150	33.178	-1672.0	5863.3	91.12	31.14	43.59	1476
155	32.950	-1506.5	6080.7	92.55	30.87	43.41	1466
160	32.725	-1342.2	6297.3	93.92	30.62	43.22	1456
165	32.502	-1178.8	6512.9	95.25	30.38	43.03	1447
170	32.283	-1016.5	6727.6	96.53	30.15	42.84	1438
175	32.066	-855.21	6941.3	97.77	29.93	42.64	1430
180	31.851	-694.91	7154.1	98.97	29.72	42.45	1421
185	31.640	-535.60	7365.8	100.13	29.52	42.25	1413
190	31.432	-377.26	7576.5	101.25	29.32	42.05	1406
195	31.226	-219.89	7786.3	102.34	29.14	41.85	1398
200	31.023	-63.46	7995.0	103.40	28.96	41.65	1391
210	30.627	246.60	8409.5	105.42	28.63	41.25	1377
220	30.241	553.07	8820.0	107.33	28.31	40.86	1364
230	29.867	856.07	9226.6	109.14	28.03	40.47	1352
240	29.503	1155.8	9629.5	110.86	27.76	40.10	1341
250	29.150	1452.3	10029.	112.49	27.51	39.74	1330
260	28.806	1745.7	10424.	114.04	27.28	39.40	1320
270	28.473	2036.3	10817.	115.52	27.06	39.07	1310
280	28.148	2324.2	11206.	116.93	26.86	38.75	1301
290	27.833	2609.4	11592.	118.29	26.67	38.45	1293
300	27.526	2892.2	11975.	119.59	26.49	38.16	1285
310	27.226	3172.6	12355.	120.83	26.32	37.88	1277
320	26.935	3450.9	12732.	122.03	26.17	37.62	1270
330	26.651	3727.0	13107.	123.18	26.02	37.38	1263
340	26.374	4001.2	13480.	124.30	25.89	37.15	1257
350	26.104	4273.5	13850.	125.37	25.76	36.93	1250
360	25.841	4544.0	14219.	126.41	25.64	36.72	1245
370	25.583	4812.9	14585.	127.41	25.53	36.52	1239
380	25.332	5080.3	14949.	128.38	25.43	36.34	1234
390	25.086	5346.2	15312.	129.32	25.34	36.17	1229

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
400	24.846	5610.7	15673.	130.24	25.25	36.01	1224
420	24.382	6136.1	16390.	131.99	25.10	35.71	1215
440	23.937	6657.1	17101.	133.64	24.97	35.46	1207
460	23.509	7174.3	17808.	135.21	24.87	35.24	1200
480	23.099	7688.3	18511.	136.71	24.79	35.05	1193
500	22.705	8199.6	19210.	138.14	24.73	34.89	1187
520	22.325	8708.7	19907.	139.50	24.69	34.76	1182
540	21.959	9216.1	20601.	140.81	24.67	34.65	1177
560	21.606	9722.1	21293.	142.07	24.66	34.56	1172
580	21.266	10227.	21983.	143.28	24.66	34.49	1168
600	20.936	10731.	22672.	144.45	24.68	34.43	1164
620	20.618	11235.	23361.	145.58	24.71	34.40	1161
640	20.310	11739.	24048.	146.67	24.74	34.37	1158
660	20.012	12243.	24736.	147.73	24.79	34.36	1156
680	19.723	12748.	25423.	148.75	24.84	34.36	1153
700	19.443	13252.	26110.	149.75	24.90	34.37	1151
720	19.172	13758.	26798.	150.72	24.97	34.38	1150
740	18.908	14264.	27486.	151.66	25.04	34.41	1148
760	18.652	14771.	28174.	152.58	25.11	34.43	1147
780	18.404	15279.	28863.	153.47	25.18	34.47	1146
800	18.163	15788.	29553.	154.35	25.26	34.50	1145
850	17.587	17066.	31280.	156.44	25.46	34.61	1144
900	17.050	18351.	33014.	158.42	25.67	34.73	1144
950	16.547	19645.	34754.	160.30	25.88	34.86	1145
1000	16.074	20947.	36500.	162.10	26.08	34.99	1146
1050	15.630	22258.	38253.	163.81	26.27	35.12	1149
1100	15.211	23576.	40012.	165.44	26.46	35.25	1152
1150	14.815	24903.	41778.	167.01	26.64	35.37	1155
1200	14.440	26237.	43549.	168.52	26.80	35.49	1159
			300.00 MPa Isobar				
* 113.52	35.804	-2924.0	5455.0	76.95	34.47	44.50	1658
114	35.783	-2907.5	5476.4	77.14	34.42	44.48	1656
116	35.696	-2839.1	5565.3	77.91	34.23	44.40	1651
118	35.609	-2770.9	5654.0	78.67	34.05	44.33	1646
120	35.522	-2703.0	5742.6	79.41	33.88	44.26	1641
122	35.435	-2635.2	5831.0	80.15	33.71	44.19	1636
124	35.348	-2567.7	5919.4	80.86	33.55	44.12	1631
126	35.261	-2500.4	6007.5	81.57	33.40	44.06	1626
128	35.175	-2433.2	6095.6	82.26	33.25	44.00	1621
130	35.088	-2366.3	6183.6	82.94	33.11	43.95	1617
132	35.002	-2299.5	6271.4	83.61	32.97	43.89	1612

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
134	34.916	-2232.9	6359.2	84.27	32.83	43.83	1608
136	34.830	-2166.4	6446.7	84.92	32.70	43.78	1604
138	34.745	-2100.1	6534.2	85.56	32.57	43.72	1599
140	34.660	-2034.0	6621.6	86.19	32.45	43.67	1595
142	34.574	-1968.1	6708.9	86.81	32.33	43.61	1591
144	34.489	-1902.2	6796.1	87.42	32.21	43.56	1587
146	34.405	-1836.6	6883.2	88.02	32.10	43.50	1583
148	34.320	-1771.1	6970.1	88.61	31.98	43.44	1579
150	34.236	-1705.7	7057.0	89.19	31.87	43.39	1575
155	34.027	-1543.0	7273.5	90.61	31.61	43.24	1565
160	33.820	-1381.1	7489.3	91.99	31.36	43.09	1556
165	33.615	-1220.1	7704.4	93.31	31.12	42.94	1547
170	33.412	-1060.0	7918.7	94.59	30.89	42.78	1539
175	33.212	-900.80	8132.2	95.83	30.68	42.62	1531
180	33.013	-742.43	8344.9	97.02	30.47	42.45	1523
185	32.817	-584.91	8556.7	98.18	30.27	42.28	1515
190	32.623	-428.23	8767.6	99.31	30.07	42.10	1507
195	32.432	-272.38	8977.7	100.40	29.89	41.93	1500
200	32.243	-117.36	9186.9	101.46	29.71	41.75	1493
210	31.873	190.24	9602.7	103.49	29.37	41.39	1480
220	31.512	494.66	10015.	105.41	29.06	41.04	1467
230	31.161	795.98	10423.	107.22	28.76	40.68	1455
240	30.819	1094.3	10828.	108.95	28.49	40.33	1444
250	30.487	1389.8	11230.	110.59	28.23	39.99	1434
260	30.163	1682.4	11628.	112.15	27.99	39.66	1424
270	29.848	1972.5	12023.	113.64	27.76	39.34	1414
280	29.541	2259.9	12415.	115.06	27.55	39.03	1405
290	29.243	2545.0	12804.	116.43	27.35	38.73	1397
300	28.952	2827.7	13190.	117.74	27.16	38.45	1389
310	28.668	3108.3	13573.	118.99	26.99	38.17	1381
320	28.391	3386.7	13953.	120.20	26.82	37.91	1374
330	28.121	3663.2	14331.	121.36	26.67	37.67	1367
340	27.858	3937.7	14707.	122.48	26.52	37.43	1361
350	27.600	4210.5	15080.	123.57	26.39	37.21	1354
360	27.349	4481.7	15451.	124.61	26.26	37.00	1348
370	27.103	4751.2	15820.	125.62	26.14	36.80	1343
380	26.863	5019.3	16187.	126.60	26.03	36.61	1337
390	26.628	5285.9	16552.	127.55	25.93	36.43	1332
400	26.399	5551.2	16916.	128.47	25.83	36.26	1327
420	25.953	6078.3	17638.	130.23	25.66	35.96	1318
440	25.526	6601.1	18354.	131.90	25.52	35.69	1309
460	25.115	7120.3	19065.	133.48	25.40	35.46	1301
480	24.720	7636.3	19772.	134.98	25.31	35.26	1294
500	24.339	8149.7	20476.	136.42	25.23	35.09	1287
520	23.971	8661.0	21176.	137.79	25.18	34.94	1281

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
540	23.616	9170.6	21874.	139.11	25.14	34.82	1275
560	23.273	9678.9	22569.	140.37	25.12	34.73	1270
580	22.942	10186.	23263.	141.59	25.11	34.65	1265
600	22.620	10693.	23955.	142.76	25.12	34.59	1260
620	22.309	11199.	24647.	143.90	25.14	34.55	1256
640	22.007	11705.	25337.	144.99	25.16	34.52	1252
660	21.714	12212.	26028.	146.06	25.20	34.50	1249
680	21.429	12718.	26718.	147.09	25.24	34.50	1246
700	21.153	13225.	27408.	148.09	25.29	34.50	1243
720	20.884	13733.	28098.	149.06	25.35	34.52	1240
740	20.623	14241.	28788.	150.00	25.41	34.54	1238
760	20.369	14751.	29479.	150.93	25.47	34.56	1236
780	20.121	15261.	30171.	151.82	25.54	34.60	1234
800	19.880	15773.	30863.	152.70	25.61	34.63	1232
850	19.303	17056.	32597.	154.80	25.79	34.74	1229
900	18.762	18347.	34337.	156.79	25.98	34.86	1227
950	18.252	19647.	36083.	158.68	26.17	34.99	1226
1000	17.771	20954.	37836.	160.48	26.36	35.12	1226
1050	17.316	22270.	39595.	162.19	26.54	35.25	1227
1100	16.885	23593.	41360.	163.84	26.72	35.37	1228
1150	16.477	24925.	43132.	165.41	26.89	35.50	1230
1200	16.089	26264.	44910.	166.93	27.04	35.61	1233
			350.00 MPa Isobar				
* 120.15	36.327	-2686.9	6947.8	77.86	34.47	43.87	1727
122	36.254	-2625.5	7028.7	78.53	34.31	43.81	1722
124	36.174	-2559.1	7116.3	79.24	34.15	43.76	1717
126	36.095	-2492.8	7203.8	79.94	34.00	43.71	1713
128	36.016	-2426.8	7291.2	80.63	33.85	43.66	1708
130	35.937	-2360.9	7378.4	81.31	33.71	43.61	1704
132	35.858	-2295.3	7465.6	81.97	33.57	43.56	1699
134	35.779	-2229.7	7552.7	82.63	33.44	43.52	1695
136	35.700	-2164.3	7639.7	83.27	33.31	43.48	1691
138	35.621	-2099.1	7726.6	83.91	33.19	43.43	1687
140	35.542	-2034.0	7813.4	84.53	33.06	43.39	1683
142	35.464	-1969.0	7900.2	85.15	32.95	43.35	1679
144	35.386	-1904.2	7986.8	85.75	32.83	43.31	1675
146	35.308	-1839.5	8073.4	86.35	32.72	43.27	1671
148	35.230	-1775.0	8159.9	86.94	32.61	43.22	1667
150	35.152	-1710.6	8246.3	87.52	32.50	43.18	1663
155	34.958	-1550.1	8461.9	88.93	32.24	43.07	1654
160	34.766	-1390.3	8676.9	90.30	32.00	42.95	1645

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
165	34.576	-1231.4	8891.4	91.62	31.77	42.83	1636
170	34.387	-1073.2	9105.2	92.89	31.54	42.70	1628
175	34.200	-915.70	9318.4	94.13	31.33	42.57	1620
180	34.014	-758.97	9530.9	95.33	31.12	42.43	1612
185	33.831	-602.97	9742.7	96.49	30.93	42.29	1605
190	33.649	-447.70	9953.7	97.61	30.73	42.14	1598
195	33.470	-293.16	10164.	98.71	30.55	41.99	1591
200	33.292	-139.34	10374.	99.77	30.37	41.84	1584
210	32.944	166.17	10790.	101.80	30.04	41.52	1571
220	32.603	468.86	11204.	103.72	29.72	41.20	1559
230	32.271	768.79	11614.	105.55	29.42	40.87	1547
240	31.948	1066.0	12022.	107.28	29.14	40.55	1536
250	31.632	1360.7	12425.	108.93	28.88	40.23	1526
260	31.324	1652.7	12826.	110.50	28.63	39.92	1516
270	31.025	1942.4	13224.	112.00	28.40	39.61	1507
280	30.732	2229.6	13618.	113.44	28.18	39.31	1498
290	30.447	2514.6	14010.	114.81	27.97	39.02	1489
300	30.169	2797.5	14399.	116.13	27.78	38.74	1481
310	29.898	3078.2	14785.	117.40	27.59	38.47	1474
320	29.633	3357.0	15168.	118.61	27.42	38.21	1467
330	29.374	3633.9	15549.	119.79	27.26	37.96	1460
340	29.122	3908.9	15928.	120.92	27.11	37.73	1453
350	28.875	4182.3	16304.	122.01	26.96	37.50	1447
360	28.633	4454.1	16678.	123.06	26.83	37.29	1441
370	28.397	4724.3	17049.	124.08	26.70	37.08	1435
380	28.166	4993.1	17419.	125.06	26.58	36.89	1429
390	27.940	5260.6	17787.	126.02	26.47	36.71	1424
400	27.719	5526.7	18153.	126.95	26.37	36.53	1419
420	27.290	6055.6	18881.	128.72	26.18	36.22	1409
440	26.877	6580.2	19602.	130.40	26.03	35.94	1400
460	26.480	7101.3	20319.	131.99	25.90	35.69	1392
480	26.098	7619.3	21030.	133.51	25.79	35.48	1384
500	25.729	8134.8	21738.	134.95	25.70	35.30	1377
520	25.373	8648.1	22443.	136.33	25.64	35.15	1370
540	25.028	9159.8	23144.	137.66	25.59	35.02	1364
560	24.694	9670.1	23843.	138.93	25.56	34.91	1358
580	24.371	10180.	24541.	140.15	25.54	34.83	1353
600	24.058	10688.	25237.	141.33	25.53	34.76	1347
620	23.754	11197.	25931.	142.47	25.54	34.71	1343
640	23.458	11705.	26625.	143.57	25.56	34.67	1338
660	23.171	12213.	27318.	144.64	25.59	34.65	1334
680	22.892	12722.	28011.	145.67	25.62	34.64	1330
700	22.620	13231.	28704	146.68	25.66	34.64	1327
720	22.356	13741.	29397.	147.65	25.71	34.65	1324
740	22.098	14251.	30090.	148.60	25.76	34.66	1321

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
760	21.847	14763.	30783.	149.53	25.82	34.69	1318
780	21.602	15275.	31477.	150.43	25.88	34.71	1315
800	21.363	15789.	32172.	151.31	25.94	34.75	1313
850	20.790	17077.	33912.	153.42	26.11	34.85	1308
900	20.250	18373.	35657.	155.41	26.28	34.96	1305
950	19.739	19677.	37408.	157.31	26.46	35.09	1302
1000	19.256	20989.	39165.	159.11	26.64	35.21	1300
1050	18.796	22309.	40929.	160.83	26.81	35.34	1300
1100	18.360	23637.	42700.	162.48	26.97	35.47	1300
1150	17.945	24972.	44476.	164.06	27.13	35.59	1300
1200	17.549	26315.	46259.	165.57	27.27	35.71	1302
			400.00 MPa Isobar				
* 126.69	36.809	-2442.3	8424.9	78.75	34.45	43.33	1790
128	36.761	-2399.8	8481.4	79.20	34.36	43.31	1787
130	36.688	-2334.9	8567.9	79.87	34.22	43.27	1782
132	36.615	-2270.1	8654.4	80.53	34.08	43.23	1778
134	36.542	-2205.5	8740.8	81.18	33.95	43.20	1774
136	36.469	-2141.0	8827.2	81.82	33.83	43.17	1770
138	36.396	-2076.7	8913.5	82.45	33.71	43.14	1766
140	36.323	-2012.5	8999.8	83.07	33.59	43.11	1762
142	36.251	-1948.4	9086.0	83.68	33.47	43.08	1758
144	36.178	-1884.4	9172.1	84.28	33.36	43.05	1754
146	36.105	-1820.6	9258.1	84.87	33.25	43.02	1750
148	36.033	-1756.9	9344.1	85.46	33.14	42.98	1746
150	35.961	-1693.3	9430.1	86.04	33.04	42.95	1743
155	35.780	-1534.7	9644.6	87.44	32.79	42.87	1734
160	35.601	-1376.9	9858.8	88.80	32.55	42.79	1725
165	35.423	-1219.7	10073.	90.12	32.32	42.70	1717
170	35.246	-1063.1	10286.	91.39	32.11	42.60	1709
175	35.070	-907.25	10499.	92.63	31.90	42.50	1701
180	34.896	-751.98	10711.	93.82	31.70	42.39	1694
185	34.723	-597.34	10922.	94.98	31.50	42.27	1686
190	34.552	-443.33	11133.	96.11	31.32	42.15	1679
195	34.383	-289.95	11344.	97.20	31.14	42.02	1672
200	34.215	-137.19	11554.	98.26	30.96	41.89	1666
210	33.885	166.44	11971.	100.30	30.63	41.62	1653
220	33.562	467.59	12386.	102.23	30.31	41.33	1641
230	33.246	766.29	12798.	104.06	30.02	41.04	1630
240	32.938	1062.6	13207.	105.80	29.73	40.74	1619
250	32.637	1356.5	13613.	107.46	29.47	40.45	1609
260	32.343	1648.0	14016.	109.04	29.22	40.15	1599

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
270	32.056	1937.4	14416.	110.55	28.98	39.86	1590
280	31.775	2224.5	14813.	111.99	28.76	39.57	1581
290	31.502	2509.5	15207.	113.38	28.55	39.29	1573
300	31.235	2792.5	15599.	114.70	28.34	39.02	1565
310	30.974	3073.5	15988.	115.98	28.15	38.76	1557
320	30.719	3352.6	16374.	117.20	27.98	38.50	1550
330	30.470	3630.0	16758.	118.39	27.81	38.25	1543
340	30.227	3905.6	17139.	119.52	27.65	38.02	1537
350	29.989	4179.6	17518.	120.62	27.50	37.79	1530
360	29.756	4452.0	17895.	121.68	27.35	37.58	1524
370	29.528	4722.9	18270.	122.71	27.22	37.37	1518
380	29.305	4992.5	18642.	123.70	27.10	37.17	1513
390	29.086	5260.8	19013.	124.67	26.98	36.99	1507
400	28.872	5527.8	19382.	125.60	26.87	36.81	1502
420	28.456	6058.4	20115.	127.39	26.67	36.49	1492
440	28.057	6584.9	20842.	129.08	26.50	36.20	1483
460	27.672	7107.9	21563.	130.68	26.36	35.94	1474
480	27.301	7627.9	22280.	132.21	26.24	35.72	1466
500	26.942	8145.4	22992.	133.66	26.14	35.53	1459
520	26.595	8660.7	23701.	135.05	26.07	35.36	1452
540	26.260	9174.4	24407.	136.39	26.01	35.22	1445
560	25.935	9686.8	25110.	137.66	25.97	35.11	1439
580	25.620	10198.	25811.	138.89	25.94	35.01	1433
600	25.314	10709.	26511.	140.08	25.92	34.94	1427
620	25.016	11219.	27209.	141.22	25.92	34.88	1422
640	24.728	11730.	27906.	142.33	25.93	34.83	1417
660	24.446	12240.	28602.	143.40	25.95	34.80	1413
680	24.173	12751.	29298.	144.44	25.98	34.79	1408
700	23.906	13262.	29994.	145.45	26.01	34.78	1404
720	23.646	13773.	30689.	146.43	26.05	34.78	1401
740	23.393	14286.	31385.	147.38	26.10	34.79	1397
760	23.146	14799.	32081.	148.31	26.15	34.81	1394
780	22.904	15313.	32777.	149.21	26.20	34.83	1391
800	22.668	15828.	33474.	150.10	26.26	34.86	1388
850	22.102	17121.	35219.	152.21	26.41	34.95	1382
900	21.566	18422.	36970.	154.21	26.57	35.06	1377
950	21.057	19730.	38725.	156.11	26.74	35.18	1373
1000	20.574	21046.	40487.	157.92	26.90	35.30	1370
1050	20.115	22370.	42256.	159.65	27.06	35.43	1368
1100	19.677	23701.	44030.	161.30	27.21	35.55	1367
1150	19.258	25040.	45811.	162.88	27.36	35.67	1366
1200	18.859	26387.	47597.	164.40	27.50	35.79	1367

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
			450.00 MPa Isobar				
* 132.98	37.262	-2196.9	9879.6	79.56	34.45	42.88	1848
134	37.228	-2164.5	9923.2	79.89	34.38	42.87	1846
136	37.160	-2100.8	10009.	80.52	34.26	42.85	1842
138	37.093	-2037.2	10095.	81.15	34.14	42.83	1838
140	37.025	-1973.8	10180.	81.76	34.03	42.81	1834
142	36.957	-1910.5	10266.	82.37	33.91	42.79	1830
144	36.889	-1847.3	10351.	82.97	33.81	42.77	1827
146	36.822	-1784.2	10437.	83.56	33.70	42.75	1823
148	36.754	-1721.2	10522.	84.14	33.60	42.73	1819
150	36.686	-1658.3	10608.	84.71	33.50	42.71	1816
155	36.518	-1501.6	10821.	86.11	33.26	42.66	1807
160	36.350	-1345.4	11034.	87.47	33.03	42.60	1798
165	36.182	-1189.8	11247.	88.78	32.81	42.54	1790
170	36.016	-1034.8	11460.	90.04	32.60	42.47	1783
175	35.850	-880.32	11672.	91.27	32.40	42.39	1775
180	35.686	-726.38	11884.	92.47	32.20	42.31	1768
185	35.523	-572.98	12095.	93.63	32.01	42.22	1760
190	35.361	-420.13	12306.	94.75	31.83	42.13	1754
195	35.200	-267.82	12516.	95.84	31.66	42.02	1747
200	35.041	-116.05	12726.	96.91	31.49	41.92	1740
210	34.727	185.85	13144.	98.95	31.16	41.68	1728
220	34.419	485.57	13560.	100.88	30.85	41.44	1716
230	34.118	783.11	13973.	102.72	30.55	41.18	1705
240	33.823	1078.5	14383.	104.46	30.27	40.91	1695
250	33.534	1371.7	14791.	106.13	30.01	40.64	1685
260	33.252	1662.8	15196.	107.71	29.76	40.36	1675
270	32.976	1951.9	15598.	109.23	29.52	40.09	1666
280	32.706	2238.9	15998.	110.69	29.29	39.81	1657
290	32.443	2523.9	16394.	112.08	29.07	39.54	1649
300	32.185	2807.0	16789.	113.41	28.87	39.28	1641
310	31.934	3088.3	17180.	114.70	28.67	39.02	1634
320	31.687	3367.8	17569.	115.93	28.49	38.77	1627
330	31.447	3645.6	17956.	117.12	28.31	38.53	1620
340	31.211	3921.8	18340.	118.27	28.15	38.30	1613
350	30.981	4196.4	18722.	119.38	27.99	38.07	1607
360	30.755	4469.5	19101.	120.45	27.85	37.86	1601
370	30.534	4741.1	19479.	121.48	27.71	37.65	1595
380	30.318	5011.5	19854.	122.48	27.58	37.45	1589
390	30.106	5280.5	20228.	123.45	27.45	37.27	1584
400	29.898	5548.4	20600.	124.39	27.34	37.09	1578

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
420	29.494	6080.7	21338.	126.19	27.13	36.76	1568
440	29.105	6609.1	22070.	127.90	26.95	36.46	1559
460	28.731	7134.0	22797.	129.51	26.80	36.20	1550
480	28.369	7656.0	23518.	131.05	26.67	35.96	1542
500	28.020	8175.4	24235.	132.51	26.56	35.76	1534
520	27.682	8692.8	24949.	133.91	26.47	35.59	1527
540	27.355	9208.5	25659.	135.25	26.41	35.44	1520
560	27.037	9722.8	26366.	136.54	26.35	35.31	1513
580	26.729	10236.	27072.	137.77	26.32	35.21	1507
600	26.430	10749.	27775.	138.97	26.30	35.12	1501
620	26.140	11261.	28477.	140.12	26.29	35.05	1496
640	25.857	11774.	29177.	141.23	26.29	35.00	1491
660	25.581	12286.	29877.	142.31	26.30	34.96	1486
680	25.313	12798.	30576.	143.35	26.32	34.94	1481
700	25.051	13311.	31274.	144.36	26.35	34.92	1477
720	24.796	13825.	31973.	145.35	26.38	34.92	1472
740	24.547	14339.	32671.	146.30	26.42	34.92	1468
760	24.304	14854.	33370.	147.23	26.46	34.93	1465
780	24.066	15370.	34069.	148.14	26.51	34.95	1461
800	23.834	15887.	34768.	149.03	26.56	34.98	1458
850	23.274	17184.	36519.	151.15	26.70	35.05	1451
900	22.744	18488.	38274.	153.16	26.85	35.15	1445
950	22.240	19800.	40034.	155.06	27.00	35.26	1440
1000	21.760	21120.	41800.	156.87	27.15	35.38	1436
1050	21.302	22448.	43572.	158.60	27.30	35.50	1433
1100	20.865	23783.	45350.	160.25	27.45	35.62	1431
1150	20.446	25125.	47134.	161.84	27.59	35.74	1429
1200	20.045	26474.	48924.	163.36	27.72	35.85	1428
			500.00 MPa Isobar				
* 138.78	37.701	-1959.4	11303.	80.22	34.46	42.49	1904
140	37.663	-1921.1	11355.	80.59	34.39	42.49	1901
142	37.599	-1858.5	11440.	81.19	34.29	42.48	1898
144	37.536	-1796.0	11525.	81.79	34.18	42.47	1894
146	37.473	-1733.6	11610.	82.37	34.08	42.46	1890
148	37.409	-1671.2	11695.	82.95	33.98	42.45	1887
150	37.346	-1609.0	11779.	83.52	33.88	42.44	1883
155	37.188	-1453.9	11992.	84.91	33.65	42.42	1875
160	37.029	-1299.2	12204.	86.26	33.43	42.39	1866
165	36.872	-1145.1	12415.	87.56	33.23	42.36	1858
170	36.715	-991.48	12627.	88.82	33.02	42.32	1851
175	36.558	-838.32	12839.	90.05	32.83	42.27	1843

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
180	36.402	-685.62	13050.	91.24	32.64	42.21	1836
185	36.248	-533.38	13261.	92.40	32.46	42.15	1829
190	36.094	-381.61	13471.	93.52	32.29	42.07	1822
195	35.941	-230.31	13681.	94.61	32.12	41.99	1816
200	35.789	-79.47	13891.	95.67	31.95	41.91	1809
210	35.490	220.79	14309.	97.71	31.63	41.72	1797
220	35.196	519.15	14725.	99.65	31.33	41.51	1786
230	34.907	815.58	15139.	101.49	31.04	41.28	1775
240	34.624	1110.1	15551.	103.24	30.76	41.04	1764
250	34.346	1402.7	15960.	104.91	30.50	40.80	1755
260	34.075	1693.3	16367.	106.51	30.25	40.54	1745
270	33.809	1982.1	16771.	108.03	30.01	40.29	1736
280	33.549	2268.9	17173.	109.49	29.78	40.03	1728
290	33.294	2554.0	17572.	110.89	29.56	39.78	1720
300	33.045	2837.3	17968.	112.24	29.35	39.52	1712
310	32.801	3118.8	18362.	113.53	29.16	39.27	1704
320	32.562	3398.7	18754.	114.77	28.97	39.03	1697
330	32.329	3676.9	19143.	115.97	28.79	38.80	1690
340	32.100	3953.6	19530.	117.12	28.62	38.57	1684
350	31.877	4228.8	19914.	118.24	28.46	38.34	1677
360	31.657	4502.5	20297.	119.32	28.31	38.13	1671
370	31.443	4774.9	20677.	120.36	28.16	37.92	1665
380	31.232	5045.9	21055.	121.37	28.03	37.73	1660
390	31.026	5315.8	21431.	122.34	27.90	37.54	1654
400	30.823	5584.4	21806.	123.29	27.78	37.36	1649
420	30.430	6118.5	22550.	125.11	27.56	37.02	1639
440	30.051	6648.7	23287.	126.82	27.37	36.72	1629
460	29.686	7175.5	24018.	128.45	27.21	36.45	1620
480	29.333	7699.4	24745.	129.99	27.07	36.21	1612
500	28.992	8220.8	25467.	131.47	26.96	36.00	1604
520	28.662	8740.1	26185.	132.88	26.86	35.81	1596
540	28.342	9257.8	26900.	134.22	26.78	35.66	1589
560	28.031	9774.1	27611.	135.52	26.73	35.52	1583
580	27.730	10290.	28321.	136.76	26.68	35.41	1576
600	27.437	10804.	29028.	137.96	26.65	35.31	1570
620	27.152	11319.	29733.	139.12	26.64	35.24	1564
640	26.875	11833.	30437.	140.24	26.63	35.18	1559
660	26.605	12347.	31140.	141.32	26.63	35.13	1554
680	26.342	12861.	31843.	142.37	26.65	35.10	1549
700	26.085	13376.	32544.	143.38	26.67	35.08	1544
720	25.834	13891.	33246.	144.37	26.70	35.06	1539
740	25.589	14407.	33947.	145.33	26.73	35.06	1535
760	25.350	14924.	34648.	146.27	26.77	35.07	1531
780	25.116	15442.	35350.	147.18	26.81	35.08	1527
800	24.887	15960.	36051.	148.07	26.86	35.10	1524

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
850	24.336	17262.	37808.	150.20	26.98	35.16	1516
900	23.812	18570.	39568.	152.21	27.12	35.25	1509
950	23.313	19886.	41333.	154.12	27.26	35.35	1503
1000	22.837	21209.	43103.	155.93	27.40	35.46	1498
1050	22.382	22540.	44879.	157.66	27.54	35.57	1494
1100	21.947	23878.	46660.	159.32	27.68	35.69	1491
1150	21.529	25224.	48448.	160.91	27.81	35.80	1488
1200	21.129	26576.	50241.	162.44	27.93	35.91	1487
			550.00 MPa Isobar				
* 144.66	38.110	-1712.5	12720.	80.91	34.46	42.16	1955
146	38.070	-1671.0	12776.	81.30	34.40	42.16	1953
148	38.010	-1609.3	12860.	81.87	34.30	42.16	1949
150	37.951	-1547.7	12945.	82.44	34.21	42.16	1946
155	37.802	-1394.0	13156.	83.82	33.99	42.16	1937
160	37.653	-1240.8	13366.	85.16	33.78	42.16	1929
165	37.504	-1088.0	13577.	86.45	33.58	42.15	1921
170	37.355	-935.68	13788.	87.71	33.39	42.14	1914
175	37.207	-783.75	13999.	88.93	33.21	42.11	1907
180	37.059	-632.21	14209.	90.12	33.03	42.08	1900
185	36.912	-481.08	14419.	91.27	32.86	42.04	1893
190	36.765	-330.33	14629.	92.39	32.69	41.99	1886
195	36.620	-179.98	14839.	93.48	32.53	41.94	1880
200	36.475	-30.03	15049.	94.54	32.37	41.87	1873
210	36.189	268.65	15467.	96.58	32.06	41.73	1861
220	35.907	565.68	15883.	98.52	31.77	41.55	1850
230	35.629	861.03	16298.	100.36	31.48	41.36	1839
240	35.357	1154.7	16710.	102.12	31.21	41.15	1829
250	35.090	1446.6	17121.	103.79	30.95	40.93	1820
260	34.827	1736.8	17529.	105.39	30.70	40.70	1810
270	34.570	2025.2	17935.	106.93	30.46	40.46	1801
280	34.319	2312.0	18338.	108.39	30.23	40.22	1793
290	34.072	2597.0	18739.	109.80	30.01	39.98	1785
300	33.831	2880.4	19138.	111.15	29.81	39.74	1777
310	33.594	3162.2	19534.	112.45	29.61	39.51	1770
320	33.362	3442.3	19928.	113.70	29.42	39.27	1763
330	33.135	3721.0	20320.	114.91	29.23	39.04	1756
340	32.913	3998.1	20709.	116.07	29.06	38.82	1749
350	32.695	4273.9	21096.	117.19	28.90	38.60	1743
360	32.482	4548.2	21481.	118.28	28.74	38.39	1737
370	32.272	4821.3	21864.	119.32	28.59	38.18	1731
380	32.067	5093.1	22244.	120.34	28.46	37.99	1725

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
390	31.866	5363.6	22623.	121.32	28.32	37.80	1720
400	31.669	5633.1	23000.	122.28	28.20	37.62	1715
420	31.285	6168.9	23749.	124.11	27.97	37.28	1704
440	30.915	6700.8	24492.	125.83	27.78	36.97	1695
460	30.558	7229.5	25228.	127.47	27.61	36.69	1686
480	30.212	7755.2	25960.	129.03	27.46	36.45	1677
500	29.879	8278.5	26686.	130.51	27.33	36.23	1669
520	29.555	8799.8	27409.	131.93	27.23	36.04	1662
540	29.242	9319.4	28128.	133.28	27.15	35.87	1654
560	28.938	9837.7	28844.	134.59	27.08	35.73	1647
580	28.642	10355.	29558.	135.84	27.03	35.61	1641
600	28.355	10872.	30269.	137.04	26.99	35.51	1634
620	28.076	11388.	30978.	138.21	26.97	35.42	1628
640	27.803	11904.	31686.	139.33	26.96	35.36	1623
660	27.538	12420.	32392.	140.42	26.96	35.30	1617
680	27.280	12936.	33098.	141.47	26.96	35.26	1612
700	27.027	13453.	33803.	142.49	26.98	35.23	1607
720	26.781	13970.	34507.	143.48	27.00	35.21	1602
740	26.540	14488.	35211.	144.45	27.03	35.20	1598
760	26.304	15006.	35915.	145.39	27.06	35.20	1593
780	26.074	15526.	36619.	146.30	27.10	35.21	1589
800	25.849	16046.	37324.	147.19	27.14	35.22	1586
850	25.305	17351.	39086.	149.33	27.25	35.27	1577
900	24.788	18663.	40851.	151.35	27.38	35.35	1569
950	24.295	19983.	42621.	153.26	27.51	35.44	1562
1000	23.824	21309.	44395.	155.08	27.64	35.54	1557
1050	23.373	22644.	46175.	156.82	27.77	35.65	1552
1100	22.941	23985.	47960.	158.48	27.90	35.75	1548
1150	22.526	25334.	49750.	160.07	28.02	35.86	1545
1200	22.127	26689.	51546.	161.60	28.14	35.97	1542
600.00 MPa Isobar							
* 150.35	38.500	-1465.4	14119.	81.54	34.46	41.86	2004
155	38.370	-1323.7	14314.	82.82	34.27	41.88	1997
160	38.229	-1171.9	14523.	84.15	34.07	41.90	1989
165	38.088	-1020.4	14733.	85.44	33.89	41.92	1981
170	37.947	-869.26	14942.	86.69	33.71	41.93	1973
175	37.806	-718.49	15152.	87.91	33.54	41.93	1966
180	37.666	-568.06	15362.	89.09	33.37	41.93	1959
185	37.525	-417.97	15571.	90.24	33.20	41.91	1952
190	37.386	-268.21	15781.	91.35	33.05	41.89	1946
195	37.247	-118.78	15990.	92.44	32.89	41.85	1940

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
200	37.108	30.31	16199.	93.50	32.74	41.81	1933
210	36.834	327.45	16617.	95.54	32.44	41.70	1922
220	36.563	623.19	17033.	97.48	32.16	41.57	1910
230	36.296	917.47	17448.	99.32	31.88	41.41	1900
240	36.034	1210.2	17861.	101.08	31.62	41.23	1890
250	35.776	1501.5	18273.	102.76	31.36	41.04	1880
260	35.522	1791.2	18682.	104.36	31.12	40.83	1871
270	35.273	2079.3	19089.	105.90	30.88	40.62	1862
280	35.029	2365.9	19494.	107.37	30.66	40.39	1854
290	34.790	2650.9	19897.	108.79	30.44	40.17	1846
300	34.555	2934.3	20298.	110.14	30.23	39.94	1839
310	34.325	3216.3	20696.	111.45	30.03	39.72	1831
320	34.100	3496.7	21092.	112.71	29.84	39.49	1824
330	33.879	3775.8	21486.	113.92	29.65	39.27	1817
340	33.662	4053.4	21877.	115.09	29.48	39.05	1811
350	33.450	4329.6	22267.	116.22	29.31	38.84	1804
360	33.242	4604.6	22654.	117.31	29.15	38.63	1798
370	33.037	4878.2	23040.	118.36	29.00	38.43	1793
380	32.837	5150.7	23423.	119.39	28.86	38.23	1787
390	32.640	5422.0	23804.	120.38	28.72	38.05	1781
400	32.447	5692.2	24184.	121.34	28.60	37.86	1776
420	32.072	6229.6	24938.	123.18	28.36	37.53	1766
440	31.710	6763.3	25685.	124.92	28.16	37.22	1756
460	31.360	7293.7	26426.	126.56	27.98	36.94	1747
480	31.022	7821.3	27163.	128.13	27.83	36.68	1739
500	30.695	8346.5	27894.	129.62	27.69	36.46	1730
520	30.378	8869.7	28621.	131.05	27.58	36.26	1723
540	30.070	9391.3	29345.	132.41	27.49	36.09	1715
560	29.772	9911.5	30065.	133.72	27.42	35.94	1708
580	29.482	10431.	30782.	134.98	27.36	35.81	1701
600	29.200	10949.	31498.	136.20	27.32	35.70	1695
620	28.925	11467.	32211.	137.36	27.29	35.61	1689
640	28.658	11985.	32922.	138.49	27.27	35.54	1683
660	28.397	12503.	33632.	139.59	27.26	35.47	1677
680	28.143	13021.	34341.	140.64	27.27	35.43	1672
700	27.894	13540.	35049.	141.67	27.27	35.39	1667
720	27.652	14059.	35757.	142.67	27.29	35.37	1662
740	27.415	14578.	36464.	143.64	27.31	35.35	1657
760	27.183	15098.	37171.	144.58	27.34	35.34	1652
780	26.956	15619.	37878.	145.50	27.37	35.34	1648
800	26.734	16141.	38585.	146.39	27.41	35.35	1644
850	26.198	17451.	40353.	148.54	27.51	35.39	1635
900	25.688	18767.	42124.	150.56	27.63	35.45	1626
950	25.201	20090.	43898.	152.48	27.75	35.53	1619
1000	24.735	21420.	45677.	154.30	27.87	35.62	1613

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
1050	24.289	22757.	47461.	156.04	28.00	35.72	1607
1100	23.860	24102.	49249.	157.71	28.11	35.82	1603
1150	23.448	25454.	51043.	159.30	28.23	35.92	1599
1200	23.051	26812.	52841.	160.83	28.34	36.02	1595
			700.00 MPa Isobar				
* 161.23	39.236	-971.24	16870.	82.69	34.47	41.36	2095
165	39.140	-858.93	17026.	83.64	34.35	41.40	2090
170	39.013	-710.08	17233.	84.88	34.20	41.46	2082
175	38.885	-561.48	17440.	86.08	34.05	41.51	2075
180	38.758	-413.13	17648.	87.25	33.90	41.55	2068
185	38.630	-265.01	17856.	88.39	33.76	41.58	2062
190	38.502	-117.12	18064.	89.50	33.62	41.60	2055
195	38.375	30.55	18272.	90.58	33.49	41.61	2049
200	38.248	177.99	18480.	91.64	33.35	41.61	2043
210	37.995	472.16	18896.	93.67	33.09	41.59	2032
220	37.744	765.35	19311.	95.60	32.83	41.53	2021
230	37.496	1057.5	19726.	97.44	32.58	41.44	2011
240	37.251	1348.5	20140.	99.20	32.33	41.32	2001
250	37.010	1638.3	20552.	100.89	32.09	41.18	1991
260	36.772	1927.0	20963.	102.50	31.86	41.02	1983
270	36.537	2214.4	21373.	104.05	31.63	40.85	1974
280	36.307	2500.5	21780.	105.53	31.41	40.67	1966
290	36.081	2785.3	22186.	106.95	31.20	40.48	1958
300	35.858	3068.8	22590.	108.32	30.99	40.28	1951
310	35.640	3351.0	22992.	109.64	30.79	40.08	1943
320	35.426	3631.9	23391.	110.91	30.60	39.87	1936
330	35.215	3911.5	23789.	112.13	30.42	39.67	1930
340	35.009	4189.9	24185.	113.31	30.24	39.47	1923
350	34.806	4467.0	24579.	114.45	30.07	39.27	1917
360	34.607	4743.0	24970.	115.56	29.91	39.07	1911
370	34.411	5017.9	25360.	116.62	29.75	38.88	1905
380	34.219	5291.6	25748.	117.66	29.61	38.69	1899
390	34.031	5564.2	26134.	118.66	29.47	38.51	1894
400	33.846	5835.9	26518.	119.63	29.34	38.33	1889
420	33.485	6376.3	27281.	121.50	29.09	37.99	1878
440	33.137	6913.3	28038.	123.26	28.87	37.68	1869
460	32.800	7447.1	28789.	124.93	28.68	37.40	1860
480	32.474	7978.3	29534.	126.51	28.52	37.14	1851
500	32.158	8507.1	30275.	128.02	28.37	36.91	1843
520	31.852	9034.0	31011.	129.47	28.25	36.70	1835
540	31.555	9559.2	31743.	130.85	28.15	36.52	1827

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
560	31.267	10083.	32471.	132.17	28.06	36.35	1820
580	30.986	10606.	33197.	133.45	27.99	36.21	1813
600	30.713	11129.	33920.	134.67	27.94	36.09	1806
620	30.447	11650.	34641.	135.85	27.90	35.99	1800
640	30.188	12172.	35360.	136.99	27.87	35.90	1793
660	29.936	12693.	36077.	138.10	27.85	35.82	1787
680	29.689	13215.	36793.	139.17	27.84	35.76	1782
700	29.449	13737.	37507.	140.20	27.84	35.72	1776
720	29.213	14260.	38221.	141.21	27.85	35.68	1771
740	28.983	14783.	38935.	142.19	27.86	35.65	1766
760	28.758	15306.	39647.	143.14	27.88	35.63	1761
780	28.538	15831.	40360.	144.06	27.90	35.62	1756
800	28.322	16356.	41072.	144.96	27.93	35.61	1752
850	27.800	17673.	42853.	147.12	28.01	35.63	1742
900	27.303	18997.	44635.	149.16	28.11	35.66	1732
950	26.828	20327.	46420.	151.09	28.21	35.72	1724
1000	26.372	21665.	48208.	152.92	28.32	35.79	1717
1050	25.935	23009.	49999.	154.67	28.43	35.87	1710
1100	25.515	24360.	51795.	156.34	28.53	35.96	1704
1150	25.110	25717.	53595.	157.94	28.63	36.04	1699
1200	24.719	27081.	55400.	159.48	28.73	36.13	1695
			800.00 MPa Isobar				
* 171.20	39.927	-487.41	19549.	83.61	34.50	40.94	2179
175	39.839	-375.87	19705.	84.51	34.40	41.01	2174
180	39.722	-229.45	19910.	85.67	34.28	41.09	2167
185	39.606	-83.17	20116.	86.80	34.17	41.17	2160
190	39.488	62.96	20322.	87.89	34.05	41.23	2154
195	39.371	208.95	20528.	88.97	33.94	41.28	2148
200	39.254	354.80	20735.	90.01	33.82	41.33	2142
210	39.020	646.08	21148.	92.03	33.60	41.38	2131
220	38.787	936.75	21562.	93.95	33.37	41.39	2120
230	38.555	1226.7	21976.	95.79	33.15	41.37	2110
240	38.326	1515.9	22390.	97.55	32.93	41.31	2101
250	38.099	1804.3	22802.	99.24	32.71	41.23	2091
260	37.874	2091.8	23214.	100.85	32.49	41.13	2083
270	37.653	2378.3	23625.	102.40	32.27	41.00	2074
280	37.435	2663.8	24034.	103.89	32.06	40.86	2066
290	37.220	2948.2	24442.	105.32	31.86	40.71	2059
300	37.009	3231.6	24848.	106.70	31.66	40.54	2051
310	36.800	3513.9	25253.	108.03	31.47	40.37	2044
320	36.596	3795.0	25656.	109.31	31.28	40.19	2037

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
330	36.394	4075.1	26057.	110.54	31.10	40.01	2031
340	36.196	4354.1	26456.	111.73	30.92	39.82	2024
350	36.002	4632.0	26853.	112.88	30.75	39.64	2018
360	35.811	4908.9	27248.	114.00	30.59	39.46	2012
370	35.623	5184.7	27642.	115.08	30.43	39.28	2006
380	35.438	5459.5	28034.	116.12	30.29	39.10	2001
390	35.257	5733.4	28424.	117.13	30.14	38.92	1995
400	35.078	6006.3	28812.	118.12	30.01	38.75	1990
420	34.730	6549.5	29584.	120.00	29.76	38.42	1980
440	34.394	7089.4	30350.	121.78	29.53	38.11	1970
460	34.068	7626.5	31109.	123.47	29.33	37.83	1961
480	33.753	8161.0	31863.	125.07	29.15	37.57	1952
500	33.447	8693.2	32612.	126.60	29.00	37.33	1944
520	33.150	9223.7	33356.	128.06	28.87	37.12	1936
540	32.862	9752.5	34097.	129.46	28.75	36.93	1928
560	32.582	10280.	34834.	130.80	28.66	36.76	1920
580	32.310	10807.	35567.	132.09	28.58	36.60	1913
600	32.045	11333.	36298.	133.32	28.52	36.47	1906
620	31.786	11858.	37026.	134.52	28.47	36.36	1900
640	31.535	12383.	37752.	135.67	28.43	36.26	1893
660	31.289	12909.	38476.	136.79	28.40	36.17	1887
680	31.049	13434.	39199.	137.86	28.38	36.10	1881
700	30.815	13959.	39921.	138.91	28.37	36.04	1876
720	30.586	14485.	40641.	139.92	28.37	35.99	1870
740	30.362	15012.	41360.	140.91	28.38	35.95	1865
760	30.143	15539.	42079.	141.87	28.39	35.92	1860
780	29.928	16067.	42797.	142.80	28.40	35.90	1855
800	29.718	16595.	43515.	143.71	28.42	35.89	1850
850	29.209	17921.	45309.	145.89	28.49	35.87	1839
900	28.724	19252.	47103.	147.94	28.57	35.89	1829
950	28.260	20590.	48898.	149.88	28.65	35.92	1820
1000	27.815	21934.	50696.	151.72	28.74	35.98	1812
1050	27.387	23285.	52496.	153.48	28.84	36.04	1804
1100	26.975	24642.	54300.	155.16	28.93	36.10	1798
1150	26.577	26006.	56107.	156.76	29.02	36.18	1792
1200	26.194	27375.	57917.	158.30	29.10	36.25	1786
			900.00 MPa Isobar				
* 181.05	40.565	7.65	22194.	84.52	34.51	40.60	2256
185	40.481	121.72	22354.	85.40	34.44	40.69	2251
190	40.373	266.17	22558.	86.48	34.35	40.79	2244
195	40.265	410.55	22762.	87.54	34.26	40.88	2238

Table 22. Thermodynamic properties of nitrogen—Continued

Temperature K	Density mol/dm^3	Internal Energy J/mol	Enthalpy J/mol	Entropy J/mol K	C_v J/mol K	C_p J/mol K	Velocity of Sound m/s
200	40.157	554.88	22967.	88.58	34.17	40.97	2232
210	39.940	843.34	23377.	90.58	33.99	41.10	2221
220	39.722	1131.5	23789.	92.50	33.80	41.18	2211
230	39.506	1419.3	24201.	94.33	33.61	41.23	2201
240	39.290	1706.6	24613.	96.08	33.41	41.23	2191
250	39.076	1993.4	25025.	97.77	33.22	41.21	2182
260	38.864	2279.6	25437.	99.38	33.02	41.15	2174
270	38.654	2565.1	25848.	100.93	32.82	41.08	2166
280	38.447	2849.9	26259.	102.43	32.63	40.98	2158
290	38.243	3133.8	26668.	103.86	32.44	40.86	2150
300	38.041	3416.9	27076.	105.24	32.25	40.73	2143
310	37.842	3699.1	27482.	106.58	32.06	40.59	2136
320	37.646	3980.4	27888.	107.86	31.88	40.44	2129
330	37.453	4260.8	28291.	109.11	31.70	40.28	2123
340	37.262	4540.2	28693.	110.31	31.53	40.12	2116
350	37.075	4818.7	29094.	111.47	31.37	39.95	2110
360	36.891	5096.3	29492.	112.59	31.21	39.79	2104
370	36.710	5372.9	29889.	113.68	31.05	39.62	2099
380	36.532	5648.7	30285.	114.73	30.90	39.45	2093
390	36.357	5923.6	30678.	115.76	30.76	39.29	2088
400	36.184	6197.6	31070.	116.75	30.62	39.13	2082
420	35.847	6743.3	31850.	118.65	30.37	38.81	2072
440	35.521	7286.0	32623.	120.45	30.14	38.51	2062
460	35.205	7826.0	33390.	122.15	29.93	38.23	2053
480	34.899	8363.6	34152.	123.77	29.75	37.97	2044
500	34.602	8899.1	34909.	125.32	29.59	37.73	2036
520	34.313	9432.9	35662.	126.80	29.45	37.51	2028
540	34.033	9965.2	36410.	128.21	29.32	37.32	2020
560	33.761	10496.	37155.	129.56	29.22	37.14	2012
580	33.495	11026.	37896.	130.86	29.13	36.98	2005
600	33.237	11556.	38634.	132.11	29.06	36.84	1998
620	32.985	12085.	39370.	133.32	29.00	36.72	1991
640	32.740	12614.	40103.	134.48	28.95	36.61	1985
660	32.501	13142.	40834.	135.61	28.92	36.52	1979
680	32.267	13671.	41564.	136.70	28.89	36.43	1973
700	32.038	14200.	42292.	137.75	28.88	36.37	1967
720	31.815	14729.	43018.	138.78	28.87	36.31	1961
740	31.596	15259.	43744.	139.77	28.86	36.26	1956
760	31.382	15790.	44469.	140.74	28.87	36.22	1950
780	31.172	16321.	45193.	141.68	28.88	36.19	1945
800	30.967	16853.	45916.	142.59	28.89	36.16	1940
850	30.470	18186.	47723.	144.78	28.94	36.12	1929
900	29.996	19525.	49529.	146.85	29.00	36.12	1918
950	29.542	20871.	51335.	148.80	29.07	36.13	1908
1000	29.107	22222.	53143.	150.66	29.15	36.17	1899

Table 22. Thermodynamic properties of nitrogen—Continued

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