NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

TECHNICAL NOTE 3273

COMPRESSIBILITY FACTOR, DENSITY, SPECIFIC HEAT, ENTHALPY, ENTROPY, FREE-ENERGY FUNCTION, VISCOSITY, AND THERMAL CONDUCTIVITY OF STEAM

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SUMMARY

The tables of thermal properties of steam that have been prepared in an NBS-NACA series have been grouped together here. They include, for the real gas, the compressibility factor, the density, the specific heat at constant pressure, the enthalpy, the entropy, the free-energy function, the viscosity, and the thermal conductivity. For the ideal gas, the specific heat, enthalpy, entropy, and free-energy function are given. For the tables given in dimensionless form, conversion factors to some frequently used units are given.

The tabular entries for the compressibility factor and density are for pressures ranging from 1 to 300 atmospheres. The temperatures cover the range from 380° K, or just above condensation, to 850° K. The tabular entries for the specific heat, enthalpy, entropy, and free-energy function are for pressures ranging from 1 to 100 atmospheres and for temperatures up to 850° K. The viscosity and thermal conductivity are tabulated as a function of pressure.

INTRODUCTION

The most widely used tabulation of the properties of steam is that by Keenan and Keyes (ref. 1), based on experimental data up to 460° C and 360 atmospheres. Koch (refs. 2 and 3) has published a table in metric units ranging from 0° to 550° C and from 0.01 to 300 atmospheres. Goff and Gratch published an accurate table (ref. 4) of low-pressure values of properties of water from -160° to 212° F. The recorrelation in 1949 by Keyes (ref. 5) of the existing data for steam and the recent experimental data of Kennedy (ref. 6) and of Kirillin and Rumjanzev (ref. 7) prompted a reexamination of the situation. The tables given in this report are a result of this investigation.

The tables for steam presented herein represent newly calculated values obtained from the correlation by Keyes (ref. 5) of all the then existing data of state. That they represent as precise and consistent a set of tables as is possible with the existing data is due in large part to the thoroughness of the correlation. During the course of the calculations, the data of Kennedy (ref. 6) were processed with a view of extending the temperature and pressure range of the tables. These data were, however, found to lack sufficient reliability to warrant their use for this purpose (see fig. 1). In view of this and the purely empirical nature of the correlation equation used, the tables could not be extended beyond the tabulated range. The data of Kirillin and Rumjanzev are in good agreement with the values of the compressibility factor obtained from the Keyes equation as is shown in figure 2.

This report is one of a series on the thermodynamic and transport properties of technically important gases compiled and calculated at the National Bureau of Standards at the suggestion and with the financial assistance of the National Advisory Committee for Aeronautics. The tables for steam which are grouped together herein for convenient use include the compressibility factor, density, specific heat at constant pressure, enthalpy, entropy, free-energy function, viscosity, and thermal conductivity for the real gas (tables 1 to 8) and the specific heat, enthalpy, entropy, and free-energy function for the ideal gas (table 9). To facilitate the use of the tables which are in dimensionless form, values of the gas constant R in various units and conversion factors to some frequently used units are listed in tables 10 to 12. A temperature interconversion table is also included (table 13).

The tables in this collection were computed over an extended period with the assistance of a number of persons. Part of the computations were performed by the Computation Laboratory of the Applied Mathematics Division under the supervision of Miss Irene Stegun. Valuable assistance has been rendered by Messrs. J. Hilsenrath and Y. S. Touloukian who are responsible for the viscosity tables. In addition, thanks are due to Prof. Touloukian who directed the attention of the authors to the measurements of the specific volume of steam by Kirillin and Rumjanzev (ref. 7).

SYMBOLS

B, C, D virial coefficients in $1/V$ series, functions of temperature

b viscosity covolume, cm^3/g

C_p heat capacity at constant pressure, various units

C_p^o heat capacity at constant pressure for ideal gas, various units

E_0^o internal energy for 1 mole of gas in ideal-gas state at 0^o K, various units

F free energy per mole in standard state, various units

F^o free energy per mole in standard state (ideal gas at 1 atmosphere for gaseous substances), various units

H enthalpy per mole, various units

H^o enthalpy per mole in standard state (ideal gas at 1 atmosphere for gaseous substances), various units

k thermal conductivity, various units

k^o thermal conductivity extrapolated to zero pressure

k_0^o thermal conductivity at 0^o C extrapolated to zero pressure

M molecular weight

N_{Pr} Prandtl number, $C_p\eta/k$

P pressure, atm

R gas constant, R'/M, 4.55465 cm^3 atm/^{o}K g

R' gas constant, cm^3 atm/^{o}K mole

S entropy per mole, various units

S^o entropy for 1 mole in standard state (ideal gas at 1 atmosphere for gaseous substances), various units.

T absolute temperature, ^{o}K

T_0 temperature at standard conditions, 273.16^o K or 491.688^o R

$t = 1/T$, $^oK^{-1}$

V	specific volume, cm^3/g
W	function in theory of viscosity, $V - \delta$
Z	compressibility factor
η	viscosity, micropoises
ρ	density, g/cm^3
ψ	temperature-volume function

STATUS OF PVT DATA FOR STEAM

The only extensive work on steam at high pressures and temperatures was published by Kennedy in 1950 (ref. 6). His work covers the range between 200° to 1,000° C and from 100 to 2,500 bars, but the data below about 300 atmospheres and above 600° C are open to question. The actual experimental work upon which Kennedy's tables are based covers the interval from 200° to 600° C at pressures up to 2,500 bars and that from 600° to 900° C at pressures from 100 to 1,400 bars; the interval from 900° to 1,000° C was explored from 100 to 800 bars. In each case the upper limit was fixed by permanent deformation of the apparatus. Extrapolation to values outside the experimental range was based on the constancy of the value of $\left(\frac{\partial P}{\partial T}\right)_V$ in the region actually investigated. Kennedy chose to use Keyes' data (refs. 5 and 8) up to 460° C and 360 atmospheres, believing them to be more accurate than his own through the critical region. Kennedy's data show an unexpected trend in the low-pressure region above 600° C. If the compressibility factor Z, computed directly from Kennedy's tabulated specific volumes, is plotted against pressure, one sees (fig. 1) that Z in this region decreases markedly for decreasing pressures. However, both theoretical and experimental evidence show that the compressibility curves could not have a maximum in this region, but rather that the compressibility factor should increase steadily, with decreasing pressure, toward unity at zero pressure.

While this report was in preparation, work done at the United Aircraft Company by Rice (ref. 9) and Hidalgo (ref. 10) was brought to the authors' attention. Hidalgo's report presents an extensive comparison of Kennedy's experimental data with values obtained from Keyes' equation (ref. 5) for the high-pressure high-temperature range covered by Kennedy.

Rice (ref. 9) has computed values of entropy and enthalpy on the basis of Kennedy's PVT results from 5,500 to 10,000 pounds per square inch and up to 1,600° F. He presents tables and charts which should be quite useful for engineering purposes. His computed values blend in quite well with values given in the steam tables (ref. 1), in that the plots of the entropy and the enthalpy against pressure for the whole pressure range and for all temperatures are continuous curves with smoothly varying slope. However, in view of the fact that the absolute values necessarily reflect the uncertainty in the PVT data on which they are based, their reliability is hard to assess.

Recently, McCullough, Pennington, and Waddington (ref. 11) obtained some accurate results on heat capacity between 361.8° and 487.2° K at pressures from about 0.2 to 1 atmosphere. They conclude that the real-gas corrections to the heat capacity, derived from Keyes' correlation, are slightly too large. This is shown by the fact that upon subtracting these corrections from the experimental values one obtains values of the ideal-gas heat capacity somewhat lower than those computed from spectroscopic and molecular-structure data. McCullough, Pennington, and Waddington (ref. 11) derived an equation which represents quite accurately their experimental data. This equation is, however, empirical and therefore applies only to their rather limited experimental range.

Kirillin and Rumjanzev (ref. 7) have measured the specific volume of steam from 431° to 600° C and from about 100 to 500 atmospheres. As seen from figure 2, the values of the compressibility factor computed from their results are in good agreement with those obtained from Keyes' equation. Kirillin's values are, in general, slightly higher than those computed from Keyes' equation, but the trend of Keyes' isotherms is reproduced by the experimental points. There is no indication of a drop in Z values with decreasing pressure. At pressures above 300 atmospheres and temperatures above 460° C, Kirillin's data tend to be higher than the calculated values by approximately 1 percent. Although this trend corroborates, in general, the trend of Kennedy's data (ref. 6), it does not provide sufficient evidence for assessing the validity of the latter data at higher pressures and temperatures. It should be remarked that, above 300 atmospheres, the calculated values shown in figure 2 were taken from Hidalgo's report (ref. 10).

VIRIAL REPRESENTATION OF PVT DATA FOR STEAM

As is well known, the compressibility factor Z of an imperfect gas can be represented as $Z = 1 + \frac{B}{V} + \frac{C}{V^2} + \frac{D}{V^3} + \ldots$, where the virial coefficients B, C, D, . . . are functions of temperature, depending on two-body, three-body, four-body, . . . interactions, respectively. If the intermolecular potential function for a gas were known, the virial coefficients could, in principle, be calculated. However, the intermolecular potential is not known exactly even for the simplest gases, and one must therefore resort to approximate models of this potential. One widely used model is the Lennard-Jones potential, which represents the attractive and repulsive energies between two molecules as proportional to the inverse sixth and twelfth power, respectively, of the intermolecular separation. This potential, however, applies only to spherical nonpolar molecules and therefore cannot be used in the case of water. A better representation is the Stockmayer potential, which is essentially a Lennard-Jones potential with an additional term representing the interaction between two point dipoles. Stockmayer (ref. 12) and Rowlinson (ref. 13) have computed second virial coefficients B on the basis of this potential. These coefficients are functions of temperature and involve a number of parameters which must be determined for each particular gas from experimental results. Rowlinson (ref. 14) has also shown that the change in the second virial coefficients due to the complexity and finite size of the charge distribution for water is small.

Recently, Rowlinson (ref. 15) has computed the third virial coefficient C on the basis of the Stockmayer potential. As he points out, in this case, it may no longer be true that the difference due to the finite size of the charge distribution is small, since, as was shown by Bird, Spotz, and Hirschfelder (ref. 16), the values of the third virial coefficient are quite sensitive to the details of the shape of the intermolecular potential.

A comparison between the values of the second virial coefficients computed on the basis of the Stockmayer potential and the "experimental" values of B shows very satisfactory agreement between 380° and 800° K. The calculated values of B were obtained using the constants suggested by Rowlinson (ref. 14) and by tables published by Bird, Spotz, and Hirschfelder (ref. 16). The experimental values of B were obtained by using the values of Z calculated on the basis of Keyes' equations (ref. 5) at very low pressure. In this case, the compressibility factor can be represented simply as $Z = 1 + \frac{B}{RT} P$, from which B can be easily derived. As shown in figure 3, at very low pressure, the plots of Z versus P obtained from Keyes' equation and from the Stockmayer potential are practically coincident.

As shown by Rowlinson (ref. 15), however, the agreement is very bad in the case of the third virial coefficient C. The disagreement between calculated and experimental values of C decreases, however, with increasing temperatures, the experimental and calculated values of C being at least of the same order of magnitude above about 750° K. It seemed interesting, therefore, to compare the calculated values of C with available experimental values at higher temperatures. An attempt has been made to fit Kennedy's data (ref. 6) to a power series, but, in view of the trend of his isotherms below 300 atmospheres, Kennedy's data in this pressure range were disregarded. This in itself makes the coefficients obtained by fitting of the experimental data uncertain, since it implies an assumption that the data above 300 atmospheres are much better than those below this pressure. Furthermore, an accurate fit of the second virial coefficient B should be based on low-pressure experimental values, where the contribution of the higher virials is small. A small misfit of the second virial is reflected in a much larger misfit of the higher coefficients. Nevertheless, on the assumption that the high-pressure data are much better than those below 300 atmospheres, an attempt was made to determine the third virial coefficients by taking the values of the second virial B at each temperature as obtained from the Stockmayer potential. The values of C thus obtained do not seem to compare well with the ones calculated by Rowlinson (ref. 15). Above 800° C, Kennedy's experimental values are so irregular that fitting becomes a matter of guess work. Hence, no conclusions can be drawn from these data relative to the third virial coefficient.

DISCUSSION AND RELIABILITY OF TABLES

Table 1.- The values of the compressibility factor Z (table 1) were computed on the basis of Keyes' equation (ref. 5)

$$\left.\begin{aligned} Z &= \frac{PV}{RT} \\ \log \frac{RT}{PV} &= \log \frac{W}{V} + \psi \frac{W}{V^2} \end{aligned}\right\} \qquad (1)$$

where

T temperature, $^{\circ}$K

$R = \frac{R'}{M} = \frac{82.0567}{18.016} = 4.55465$ cm^3 atm/deg g

P pressure, atm

V specific volume, cm^3/g

$W = V - \delta$

ρ density, $1/V$, g/cm^3

$\psi = \psi_o(1 + \psi_1\rho + \psi_2\rho^2)$

$\delta = 2.0624 \exp(-0.38\rho)$

$\psi_o = 1260.17t \exp(7.424 \times 10^4 t^2)$

$t = 1/T$, $^oK^{-1}$

For $T < T_{critical} = 647^o$ K,

$$\psi_1 = 305.6\psi_o t \exp(7.424 \times 10^4 t^2)^2$$

$$\psi_2 = 0$$

For $T > T_{critical}$,

$$\psi_1 = (479.76 + 141.5 \times 10^3 t)\psi_o t$$

$$\psi_2 = \frac{75.364 - 27.505\psi_o}{\psi_o^3}$$

The specific volume V and, hence, Z in equations (1) cannot be represented explicitly as a function of pressure and temperature, so the equations were solved by a series of successive approximations. The general procedure was to select a value of specific volume V_1 corresponding approximately to the desired values of T and P. Using this trial value of V_1, a value of Z is obtained from equations (1). This value of Z does not correspond to the desired pressure P but to a pressure

$$P_1 = Z(V_1,T)RT/V_1$$

A new value of specific volume V_2 may be obtained as

$$V_2 = Z(V_1,T)RT/P$$

This new value V_2 is in turn substituted in equations (1) to obtain a new value of Z. This value of Z corresponds to a pressure $P_2 = Z(V_2,T)RT/V_2$, which is, in general, much closer to the desired value P than the pressure P_1 obtained by first approximation.

Then, a new value V_3 is obtained as

$$V_3 = V_2 + \frac{P - P_2}{P_2 - P_1}(V_2 - V_1)$$

If $\frac{P - P_2}{P}$ is less than 0.0005, then V_3 is sufficiently close to the true solution of equations (1) for the purpose (consistency of 1 part in 10,000). If $\frac{P - P_2}{P}$ is not sufficiently small, then further approximation steps must be used by inserting V_3 in equations (1) and carrying out the above procedure as far as necessary. In general, three computations of equations (1) were sufficient. The starting values V_1 were taken for convenience from Koch's tables (refs. 2 and 3) except in the region where $0.990 < Z < 1$, where V_1 was taken as RT/P.

The tabular entries for compressibility and density are for pressures ranging from 1 to 300 atmospheres and for temperatures from 380° K, or just above condensation, to 850° K. The tables of compressibility and density are in agreement with values obtained by appropriate interpolation methods from the table of specific volumes given by Keenan and Keyes (ref. 1). It is estimated that the uncertainty in the values of the compressibility factor (table 1) does not exceed a few percent of $Z - 1$. The compressibility factor is dimensionless. Values of the gas constant R are listed in table 10 for the frequently used units in order to facilitate the use of this table.

Table 2.- The values of the density (table 2) are equally as reliable as the values of the compressibility factor, since they were computed directly from the compressibility factors, according to the equation

$$\rho = \frac{1}{V} = \frac{P}{ZRT}$$

Tables 3, 4, 5, and 6.- The tables of the dimensionless specific heat, enthalpy, entropy, and free-energy function of steam (tables 3 to 6) were obtained by adding real-gas pressure corrections to the ideal-gas tables of Glatt, Adams, and Johnston (ref. 17). The entries are for pressures ranging from 1 to 100 atmospheres and for temperatures up to 850° K or slightly higher.

Comparisons of tables of values of entropy and enthalpy must take into account the arbitrary values at the reference points for these functions. The reference point used here for both the enthalpy function and entropy is 0° K at which point the values of these properties are taken to be zero.

The corrections for nonideality to the heat capacity (table 3) were computed from the equation

$$\Delta \frac{C_p}{R} = \alpha P + \beta P^2 + \gamma P^4 + \delta P^{13} \tag{2}$$

The coefficients α, β, γ, and δ were obtained by conversion and interpolation of a table of coefficients for the equation

$$\Delta C_p = AP + BP^2 + CP^4 + DP^{13} \tag{3}$$

given by Keyes, Smith, and Gerry (ref. 8) in an earlier paper.

The pressure corrections for enthalpy and entropy (tables 4 and 5) were obtained by integration of the pressure corrections for heat capacity, since

$$\Delta \frac{H}{R} = \int \frac{\Delta C_p}{R} \, dT$$

and

$$\Delta \frac{S}{R} = \int \frac{\Delta C_p}{RT} \, dT$$

Because of the tedious nature of the calculations required in using Keyes' correlating equations (1), the derived thermodynamic quantities were obtained through the earlier correlation of the heat capacities (ref. 8) by Keyes, Smith, and Gerry which was found to be quite consistent with the correlation of the data of state. As a check of the consistency of the two apparently independent calculations, the free-energy function (table 6) was computed from both

$$-\frac{\Delta F}{RT} = \int_0^P \frac{Z - 1}{P}\, dP$$

and

$$-\frac{\Delta F}{RT} = -\left(\frac{\Delta H}{RT} - \frac{\Delta S}{R}\right)$$

The agreement between the two sets of values thus obtained is very satisfactory, the discrepancies being in the worst cases of the order of about 2 percent of the corrections. This is not surprising since the correlation yielding equations (1) is a refinement which is quite consistent with the previous correlation (ref. 8) yielding equation (3).

For the derived thermodynamic properties, the uncertainties should be approximately 10 percent of the gas imperfection correction. The values of these properties disagree with those obtained by appropriate interpolation of the Keenan and Keyes tables (ref. 1) by amounts corresponding to the differences between the values of the ideal-gas properties used here and those employed in the steam tables. A comparison of this tabulation with the Collins-Keyes formulation (ref. 18) for the ideal-gas specific heat shows table 9 to be higher by 0.015 in C_p^o/R in the temperature region 300° to 500° K.

Tables 7(a) and 7(b).- The viscosity η at 1 atmosphere (table 7(a)) was computed according to the equations given by Bonilla, Brooks, and Walker (ref. 19)

$$\eta = 0.361T - 10.2 \qquad \text{for} \quad T \leqq 800^\circ \text{ K}$$

$$\eta = \frac{39.37T^{3/2}}{33.15 - T + 0.001158T^2} \qquad \text{for} \quad T \geqq 800^\circ \text{ K}$$

where T is temperature in $^{\circ}K$ and η is in micropoises. Figure 4(a) shows a deviation plot of the calculated values and of the experimental results by various authors (refs. 19 to 25).

The viscosity η at higher pressures (table 7(b)) was computed according to Enskog theory from the equation given by Gardner in a discussion of reference 26:

$$\eta/\eta_T = 1 + 0.175b\rho + 0.8651b^2\rho^2$$

where

η_T 1-atmosphere viscosity at T° K, poises

ρ density, g/cm^3

and

$$b = \frac{1.783}{M^{1/4}}\left(\frac{\sqrt{T}}{\eta_T}\right)^{3/2} \times 10^{-7}$$

where

M molecular weight

T temperature, $^{\circ}K$

The values of density up to 850° K were taken from table 2; above 850° K they were taken from the steam tables in reference 1. Figure 4(b) shows a plot of the deviations between the calculated values and the experimental results by various authors (refs. 25 and 27 to 29).

The departures from the tabulated values of the low-pressure viscosity data for steam are shown in figure 4(a) to be less than 4 percent. The scatter of the reliable measurements at elevated pressures is higher (approximately 10 percent) as is indicated in figure 4(b).

Table 8.- The dimensionless thermal conductivity k/k_0° was computed from the equations

$$k = k^{\circ} + 1.097 \times 10^{-5}\left(10^{0.934\times10^9 P/T^4} - 1\right)$$

$$k^{o} = \frac{1.5466T^{1/2} \times 10^{-5}}{1 + \frac{1737.3}{T} 10^{-12/T}}$$

where

k thermal conductivity, cal $cm^{-1}sec^{-1}$ $^{o}K^{-1}$

k^{o} thermal conductivity extrapolated to zero pressure

T temperature, ^{o}K

P pressure, atm

The above equations are essentially those given by Keyes and Sandell as the best representation of their measurements (ref. 30). The constants have been altered to give values in terms of the thermochemical calorie. The values of thermal conductivity have been divided by $k_0{}^{o} = 3.789 \times 10^{-5}$ cal $cm^{-1}sec^{-1}$ $^{o}C^{-1}$, the value at 0^{o} C extrapolated to zero pressure.

The tabulated values (table 8) have an average deviation of 2.1 percent from the observed values as reported by Keyes and Sandell (ref. 30), whose experimental data extend to 625^{o} K and 150 atmospheres. The extrapolation of the values to the higher pressures tabulated seems justified in view of the diminishing influence of pressure at higher temperatures. These values differ appreciably from earlier data reported by Vargaftik (ref. 31) and Timroth and Vargaftik (ref. 32), the deviations ranging from 6 to 38 percent.

Figure 5 shows these departures in the low-pressure region (1 atmosphere). The broken line in the figure represents points calculated from the most recent correlation by Keyes (ref. 33).

In view of the large uncertainty in the tabulated values of the thermal conductivity and viscosity, no tabulation is made of the Prandtl numbers for steam. The values range between 1.0 and 2.0. These are compared in figure 6 with the values of the Prandtl number for steam published by Rubin (ref. 34).

Table 9.- The ideal-gas thermodynamic functions for steam tabulated herein (table 9) are those of Friedman and Haar (ref. 35) which were computed on the NBS Eastern Automatic Computer (SEAC). These authors have calculated the properties of steam to temperatures of $5,000^{o}$ K

employing a partition function expanded in closed form. The calculations include first-order correction terms for anharmonicity, rotation-vibration interaction, and centrifugal stretching. The calculations are based on the best available molecular constants obtained from extensive spectroscopic measurements by Benedict, Gailor, and Plyler (refs. 36 and 37) and by Benedict, Claassen, and Shaw (ref. 38). The same spectroscopic data were employed by Glatt, Adams, and Johnston (ref. 17) in a term-by-term summation over the energy levels of the unexpanded partition function with appropriate rotational cutoff. Except for the nuclear spin contribution of 1.3862 dimensionless units to the entropy and free-energy functions, which is not included in these tables, the tabulated values presented herein are in agreement with the tables of Glatt, Adams, and Johnston (ref. 17) which were used for the real-gas properties. The agreement of this tabulation with earlier tables (refs. 17, 18, 39, and 40) is discussed by Friedmann and Haar (ref. 35). A comparison of the heat-capacity values and of the free-energy-function values with the existing tabulations is given in figures 7 and 8, respectively.

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TABLE 1.- COMPRESSIBILITY FACTOR $Z = PV/RT$ FOR STEAM

°K	1 atm		10 atm		20 atm		40 atm		°R
380	.98591	176							684
390	.98767	145							702
400	.98912	120							720
410	.99032	101							738
420	.99133	86							756
430	.99219	75							774
440	.99294	65							792
450	.99359	56							810
460	.99415	50	.93377	671					828
470	.99465	44	.94048	569					846
480	.99509	39	.94617	488					864
490	.99548	35	.95105	423	.89209	1065			882
500	.99583	31	.95528	369	.90274	902			900
510	.99614	28	.95897	326	.91176	777			918
520	.99642	25	.96223	288	.91953	673			936
530	.99667	23	.96511	257	.92626	589	.83225	1613	954
540	.99690	21	.96768	231	.93215	521	.84838	1367	972
550	.99711	19	.96999	208	.93736	462	.86205	1174	990
560	.99730	17	.97207	188	.94198	413	.87379	1021	1008
570	.99747	16	.97395	170	.94611	372	.88400	895	1026
580	.99763	14	.97565	155	.94983	335	.89295	792	1044
590	.99777	13	.97720	142	.95318	304	.90087	705	1062
600	.99790	12	.97862	130	.95622	277	.90792	633	1080
610	.99802	12	.97992	119	.95899	253	.91425	570	1098
620	.99814	10	.98111	110	.96152	232	.91995	516	1116
630	.99824	10	.98221	102	.96384	212	.92511	469	1134
640	.99834	9	.98323	94	.96596	195	.92980	422	1152
650	.99843	9	.98417	86	.96791	178	.93402	385	1170
660	.99852	8	.98503	81	.96969	168	.93787	356	1188
670	.99860	7	.98584	75	.97137	155	.94143	329	1206
680	.99867	7	.98659	70	.97292	144	.94472	305	1224
690	.99874	6	.98729	66	.97436	134	.94777	283	1242
700	.99880	6	.98795	61	.97570	125	.95060	263	1260
710	.99886	6	.98856	57	.97695	118	.95323	245	1278
720	.99892	5	.98913	54	.97813	110	.95568	229	1296
730	.99897	5	.98967	51	.97923	103	.95797	214	1314
740	.99902	5	.99018	47	.98026	97	.96011	200	1332
750	.99907	4	.99065	45	.98123	90	.96211	188	1350
760	.99911	4	.99110	42	.98213	86	.96399	177	1368
770	.99915	4	.99152	40	.98299	80	.96576	166	1386
780	.99919	4	.99192	37	.98379	76	.96742	156	1404
790	.99923	4	.99229	36	.98455	72	.96898	147	1422
800	.99927	3	.99265	33	.98527	68	.97045	139	1440
810	.99930	3	.99298	32	.98595	64	.97184	131	1458
820	.99933	3	.99330	30	.98659	61	.97315	124	1476
830	.99936	3	.99360	29	.98720	58	.97439	117	1494
840	.99939	3	.99389	27	.98778	54	.97556	111	1512
850	.99942		.99416		.98832		.97667		1530

TABLE 1.- COMPRESSIBILITY FACTOR Z = PV/RT FOR STEAM - Continued

°K	60 atm		80 atm		100 atm		120 atm		°R
550	.76634	2397							990
560	.79031	1983							1008
570	.81014	1678	.71657	3026					1026
580	.82692	1441	.74683	2458					1044
590	.84133	1253	.77141	2053	.6840	340			1062
600	.85386	1101	.79194	1750	.7180	274	.6214	461	1080
610	.86487	975	.80944	1514	.7454	228	.6675	350	1098
620	.87462	871	.82458	1326	.7682	194	.7025	283	1116
630	.88333	782	.83784	1171	.7876	167	.7308	234	1134
640	.89115	692	.84955	1017	.8043	142	.7542	194	1152
650	.89807	625	.85972	905	.81848	1242	.7736	166	1170
660	.90432	572	.86877	823	.83090	1117	.7902	147	1188
670	.91004	526	.87700	751	.84207	1011	.80493	1316	1206
680	.91530	485	.88451	688	.85218	920	.81809	1185	1224
690	.92015	448	.89139	633	.86138	839	.82994	1074	1242
700	.92463	415	.89772	582	.86977	769	.84068	977	1260
710	.92878	385	.90354	539	.87746	707	.85045	894	1278
720	.93263	358	.90893	498	.88453	652	.85939	819	1296
730	.93621	334	.91391	463	.89105	603	.86758	755	1314
740	.93955	312	.91854	432	.89708	559	.87513	697	1332
750	.94267	291	.92286	402	.90267	520	.88210	645	1350
760	.94558	273	.92688	375	.90787	484	.88855	599	1368
770	.94831	255	.93063	350	.91271	451	.89454	557	1386
780	.95086	241	.93413	329	.91722	421	.90011	519	1404
790	.95327	226	.93742	309	.92143	395	.90530	485	1422
800	.95553	213	.94051	290	.92538	370	.91015	453	1440
810	.95766	200	.94341	273	.92908	348	.91468	425	1458
820	.95966	190	.94614	257	.93256	327	.91893	399	1476
830	.96156	179	.94871	242	.93583	308	.92292	375	1494
840	.96335	169	.95113	229	.93891	290	.92667	354	1512
850	.96504		.95342		.94181		.93021		1530

°K	120 atm		140 atm		160 atm		180 atm		°R
600	.6214	461							1080
610	.6675	350							1098
620	.7025	283	.6209	433					1116
630	.7308	234	.6642	337	.5797	518			1134
640	.7542	194	.6979	264	.6315	371	.5464	569	1152
650	.7736	166	.7243	218	.6686	289	.6033	395	1170
660	.7902	147	.7461	190	.6975	246	.6428	321	1188
670	.80493	1316	.7651	168	.7221	212	.6749	269	1206
680	.81809	1185	.78194	1495	.7433	187	.7018	231	1224
690	.82994	1074	.79689	1342	.76198	1652	.72492	2016	1242
700	.84068	977	.81031	1212	.77850	1478	.74508	1783	1260
710	.85045	894	.82243	1100	.79328	1332	.76291	1591	1278
720	.85939	819	.83343	1004	.80660	1206	.77882	1430	1296
730	.86758	755	.84347	919	.81866	1099	.79312	1294	1314
740	.87513	697	.85266	845	.82965	1005	.80606	1177	1332
750	.88210	645	.86111	780	.83970	922	.81783	1076	1350
760	.88855	599	.86891	720	.84892	851	.82859	988	1368
770	.89454	557	.87611	669	.85743	785	.83847	909	1386
780	.90011	519	.88280	621	.86528	728	.84756	840	1404
790	.90530	485	.88901	579	.87256	677	.85596	779	1422
800	.91015	453	.89480	540	.87933	630	.86375	723	1440
810	.91468	425	.90020	505	.88563	588	.87098	673	1458
820	.91893	399	.90525	473	.89151	549	.87771	627	1476
830	.92292	375	.90998	444	.89700	514	.88398	587	1494
840	.92667	354	.91442	418	.90214	485	.88985	551	1512
850	.93021		.91860		.90699		.89536		1530

TABLE 1.- COMPRESSIBILITY FACTOR Z = PV/RT FOR STEAM - Concluded

°K	180 atm		200 atm		220 atm		240 atm		°R
640	.5464	569							1152
650	.6033	395	.5206	584	.3763	1224			1170
660	.6428	321	.5790	432	.4987	625	.3751	1120	1188
670	.6749	269	.6222	344	.5612	453	.4871	628	1206
680	.7018	231	.6566	287	.6065	360	.5499	459	1224
690	.72492	2016	.6853	245	.6425	298	.5958	366	1242
700	.74508	1783	.70978	2137	.6723	255	.6324	305	1260
710	.76291	1591	.73115	1884	.69785	2220	.6629	260	1278
720	.77882	1430	.74999	1679	.72005	1956	.6889	227	1296
730	.79312	1294	.76678	1508	.73961	1743	.7116	200	1314
740	.80606	1177	.78186	1364	.75704	1565	.7316	178	1332
750	.81783	1076	.79550	1240	.77269	1415	.7494	160	1350
760	.82859	988	.80790	1133	.78684	1287	.7654	145	1368
770	.83847	909	.81923	1039	.79971	1176	.7799	132	1386
780	.84756	840	.82962	957	.81147	1079	.7931	121	1404
790	.85596	779	.83919	885	.82226	994	.8052	110	1422
800	.86375	723	.84804	819	.83220	918	.8162	102	1440
810	.87098	673	.85623	761	.84138	851	.8264	95	1458
820	.87771	627	.86384	708	.84989	790	.8359	87	1476
830	.88398	587	.87092	660	.85779	736	.8446	81	1494
840	.88985	551	.87752	619	.86515	688	.8527	76	1512
850	.89536		.88371		.87203		.8603		1530

°K	240 atm		260 atm		280 atm		300 atm		°R
660	.3751	1120							1188
670	.4871	628	.3888	952					1206
680	.5499	459	.4840	604	.4066	805	.3323	931	1224
690	.5958	366	.5444	451	.4871	564	.4254	690	1242
700	.6324	305	.5895	365	.5435	436	.4944	519	1260
710	.6629	260	.6260	305	.5871	356	.5463	413	1278
720	.6889	227	.6565	261	.6227	300	.5876	344	1296
730	.7116	200	.6826	228	.6527	259	.6220	292	1314
740	.7316	178	.7054	202	.6786	227	.6512	254	1332
750	.7494	160	.7256	180	.7013	202	.6766	224	1350
760	.7654	145	.7436	162	.7215	180	.6990	199	1368
770	.7799	132	.7598	147	.7395	162	.7189	179	1386
780	.7931	121	.7745	134	.7557	148	.7368	161	1404
790	.8052	110	.7879	122	.7705	134	.7529	147	1422
800	.8162	102	.8001	113	.7839	124	.7676	134	1440
810	.8264	95	.8114	104	.7963	113	.7810	123	1458
820	.8359	87	.8218	96	.8076	105	.7933	114	1476
830	.8446	81	.8314	89	.8181	97	.8047	105	1494
840	.8527	76	.8403	83	.8278	89	.8152	97	1512
850	.8603		.8486		.8367		.8249		1530

TABLE 2.- DENSITY ρ OF STEAM

[Values in g/cm^3]

$^{\circ}K$	1 atm		10 atm		20 atm		40 atm		$^{\circ}R$
380	.00058604	-1605							684
390	.00056999	-1506							702
400	.00055493	-1419							720
410	.00054074	-1342							738
420	.00052732	-1270							756
430	.00051462	-1208							774
440	.00050254	-1149							792
450	.00049105	-1095							810
460	.00048010	-1045	.0051115	-1445					828
470	.00046965	- 999	.0049670	-1327					846
480	.00045966	- 955	.0048343	-1229					864
490	.00045011	- 916	.0047114	-1147	.010045	-317			882
500	.00044095	- 878	.0045967	-1075	.0097284	-2851			900
510	.00043217	- 843	.0044892	-1012	.0094433	-2598			918
520	.00042374	- 810	.0043880	- 957	.0091835	-2388			936
530	.00041564	- 779	.0042923	- 907	.0089447	-2211	.019910	-740	954
540	.00040785	- 750	.0042016	- 862	.0087236	-2062	.019170	-647	972
550	.00040035	- 722	.0041154	- 821	.0085174	-1932	.018523	-576	990
560	.00039313	- 697	.0040333	- 784	.0083242	-1817	.017947	-518	1008
570	.00038616	- 672	.0039549	- 750	.0081425	-1717	.017429	-472	1026
580	.00037944	- 648	.0038799	- 718	.0079708	-1627	.016957	-434	1044
590	.00037296	- 626	.0038081	- 689	.0078081	-1545	.016523	-402	1062
600	.00036670	- 606	.0037392	- 662	.0076536	-1472	.016121	-374	1080
610	.00036064	- 586	.0036730	- 636	.0075064	-1405	.015747	-350	1098
620	.00035478	- 567	.0036094	- 613	.0073659	-1344	.015397	-329	1116
630	.00034911	- 548	.0035481	- 590	.0072315	-1286	.015068	-310	1134
640	.00034363	- 532	.0034891	- 570	.0071029	-1234	.014758	-292	1152
650	.00033831	- 516	.0034321	- 550	.0069795	-1184	.014466	-278	1170
660	.00033315	- 500	.0033771	- 531	.0068611	-1140	.014188	-265	1188
670	.00032815	- 484	.0033240	- 514	.0067471	-1099	.013923	-252	1206
680	.00032331	- 471	.0032726	- 497	.0066372	-1058	.013671	-242	1224
690	.00031860	- 457	.0032229	- 481	.0065314	-1022	.013429	-231	1242
700	.00031403	- 444	.0031748	- 467	.0064292	- 986	.013198	-222	1260
710	.00030959	- 432	.0031281	- 452	.0063306	- 955	.012976	-213	1278
720	.00030527	- 420	.0030829	- 439	.0062351	- 923	.012763	-205	1296
730	.00030107	- 408	.0030390	- 426	.0061428	- 894	.012558	-197	1314
740	.00029699	- 398	.0029964	- 414	.0060534	- 866	.012361	-190	1332
750	.00029301	- 386	.0029550	- 402	.0059668	- 839	.012171	-184	1350
760	.00028915	- 377	.0029148	- 390	.0058829	- 815	.011987	-177	1368
770	.00028538	- 367	.0028758	- 381	.0058014	- 790	.011810	-172	1386
780	.00028171	- 358	.0028377	- 369	.0057224	- 768	.011638	-165	1404
790	.00027813	- 349	.0028008	- 360	.0056456	- 747	.011473	-161	1422
800	.00027464	- 339	.0027648	- 351	.0055709	- 725	.011312	-156	1440
810	.00027125	- 332	.0027297	- 341	.0054984	- 706	.011156	-150	1458
820	.00026793	- 324	.0026956	- 333	.0054278	- 687	.011006	-147	1476
830	.00026469	- 315	.0026623	- 325	.0053591	- 669	.010859	-142	1494
840	.00026154	- 309	.0026298	- 316	.0052922	- 651	.010717	-138	1512
850	.00025845		.0025982		.0052271		.010579		1530

TABLE 2.- DENSITY ρ OF STEAM - Continued

°K	60 atm		80 atm		100 atm		120 atm		°R
550	.031254	-1489							990
560	.029765	-1238							1008
570	.028527	-1060	.043003	-2454					1026
580	.027467	- 928	.040549	-1957					1044
590	.026539	- 826	.038592	-1627	.05441	-345			1062
600	.025713	- 743	.036965	-1392	.05096	-268	.07066	-595	1080
610	.024970	- 677	.035573	-1217	.04828	-218	.06471	-422	1098
620	.024293	- 621	.034356	-1080	.04610	-185	.06049	-327	1116
630	.023672	- 574	.033276	- 971	.04425	-160	.05722	-264	1134
640	.023098	- 531	.032305	- 874	.04265	-138	.05458	-218	1152
650	.022567	- 496	.031431	- 798	.041269	-1233	.05240	-188	1170
660	.022071	- 466	.030633	- 741	.040036	-1121	.05052	-167	1188
670	.021605	- 440	.029292	- 689	.038915	-1027	.048853	-1493	1206
680	.021165	- 416	.029203	- 646	.037888	- 948	.047360	-1352	1224
690	.020749	- 396	.028557	- 606	.036940	- 879	.046008	-1237	1242
700	.020353	- 376	.027951	- 571	.036061	- 819	.044771	-1138	1260
710	.019977	- 359	.027380	- 541	.035242	- 767	.043633	-1053	1278
720	.019618	- 343	.026839	- 512	.034475	- 721	.042580	- 980	1296
730	.019275	- 328	.026327	- 486	.033754	- 680	.041600	- 916	1314
740	.018947	- 314	.025841	- 464	.033074	- 644	.040684	- 860	1332
750	.018633	- 302	.025377	- 443	.032430	- 610	.039824	- 809	1350
760	.018331	- 290	.024934	- 423	.031820	- 579	.039015	- 765	1368
770	.018041	- 279	.024511	- 405	.031241	- 552	.038250	- 724	1386
780	.017762	- 269	.024106	- 388	.030689	- 527	.037526	- 687	1404
790	.017493	- 260	.023718	- 374	.030162	- 504	.036839	- 655	1422
800	.017233	- 251	.023344	- 359	.029658	- 483	.036184	- 623	1440
810	.016982	- 242	.022985	- 346	.029175	- 464	.035561	- 596	1458
820	.016740	- 234	.022639	- 333	.028711	- 445	.034965	- 571	1476
830	.016506	- 227	.022306	- 322	.028266	- 428	.034394	- 547	1494
840	.016279	- 220	.021984	- 310	.027838	- 412	.033847	- 525	1512
850	.016059		.021674		.027426		.033322		1530

°K	120 atm		140 atm		160 atm		180 atm		°R
600	.07066	-595							1080
610	.06471	-422							1098
620	.06049	-327	.07985	-637					1116
630	.05722	-264	.07348	-466	.09619	-927			1134
640	.05458	-218	.06882	-353	.08692	-609	.1130	-122	1152
650	.05240	-188	.06529	-287	.08083	-452	.1008	- 76	1170
660	.05052	-167	.06242	-246	.07631	-370	.09315	- 575	1188
670	.048853	-1493	.05996	-215	.07261	-312	.08740	- 459	1206
680	.047360	-1352	.057808	-1906	.06949	-268	.08281	- 380	1224
690	.046008	-1237	.055902	-1712	.066814	-2351	.079009	- 3236	1242
700	.044771	-1138	.054190	-1550	.064463	-2093	.075773	- 2813	1260
710	.043633	-1053	.052640	-1416	.062370	-1881	.072960	- 2483	1278
720	.042580	- 980	.051224	-1303	.060489	-1708	.070477	- 2219	1296
730	.041600	- 916	.049921	-1206	.058781	-1562	.068258	- 2003	1314
740	.040684	- 860	.048715	-1121	.057219	-1439	.066255	- 1825	1332
750	.039824	- 809	.047594	-1048	.055780	-1332	.064430	- 1673	1350
760	.039015	- 765	.046546	- 982	.054448	-1240	.062757	- 1545	1368
770	.038250	- 724	.045564	- 925	.053208	-1159	.061212	- 1433	1386
780	.037526	- 687	.044639	- 873	.052049	-1088	.059779	- 1336	1404
790	.036839	- 655	.043766	- 827	.050961	-1024	.058443	- 1251	1422
800	.036184	- 623	.042939	- 784	.049937	- 967	.057192	- 1174	1440
810	.035561	- 596	.042155	- 747	.048970	- 917	.056018	- 1108	1458
820	.034965	- 571	.041408	- 711	.048053	- 869	.054910	- 1046	1476
830	.034394	- 547	.040697	- 680	.047184	- 827	.053864	- 993	1494
840	.033847	- 525	.040017	- 650	.046357	- 791	.052871	- 943	1512
850	.033322		.039367		.045566		.051928		1530

TABLE 2.- DENSITY ρ OF STEAM - Concluded

°K	180 atm		200 atm		220 atm		240 atm		°R
640	.1130	−122							1152
650	.1008	− 76	.1298	−149	.1975	−507			1170
660	.09315	− 575	.1149	− 96	.1468	−183	.2128	−513	1188
670	.08740	− 459	.1053	− 70	.1285	−114	.1615	−206	1206
680	.08281	− 380	.09835	− 547	.1171	− 81	.1409	−127	1224
690	.079009	− 3236	.09288	− 450	.1090	− 64	.1282	− 92	1242
700	.075773	− 2813	.088380	− 3792	.1026	− 51	.1190	− 70	1260
710	.072960	− 2483	.084588	− 3270	.09749	− 432	.1120	− 58	1278
720	.070477	− 2219	.081318	− 2870	.093169	− 3706	.1062	− 48	1296
730	.068258	− 2003	.078448	− 2553	.089463	− 3242	.1014	− 41	1314
740	.066255	− 1825	.075895	− 2296	.086221	− 2872	.09733	− 358	1332
750	.064430	− 1673	.073599	− 2083	.083349	− 2576	.09375	− 317	1350
760	.062757	− 1545	.071516	− 1905	.080773	− 2332	.09058	− 284	1368
770	.061212	− 1433	.069611	− 1753	.078441	− 2128	.08774	− 256	1386
780	.059779	− 1336	.067858	− 1623	.076313	− 1955	.08518	− 234	1404
790	.058443	− 1251	.066235	− 1511	.074358	− 1806	.08284	− 214	1422
800	.057192	− 1174	.064724	− 1410	.072552	− 1678	.08070	− 198	1440
810	.056018	− 1108	.063314	− 1323	.070874	− 1565	.07872	− 184	1458
820	.054910	− 1046	.061991	− 1245	.069309	− 1466	.07688	− 171	1476
830	.053864	− 993	.060746	− 1174	.067843	− 1378	.07517	− 160	1494
840	.052871	− 943	.059572	− 1114	.066465	− 1300	.07357	− 151	1512
850	.051928		.058458		.065165		.07206		1530

°K	240 atm		260 atm		280 atm		300 atm		°R
660	.2128	−513							1188
670	.1615	−206	.2191	−457					1206
680	.1409	−127	.1734	−214	.2223	−394	.2915	−671	1224
690	.1282	− 92	.1520	−137	.1829	−213	.2244	−341	1242
700	.1190	− 70	.1383	− 99	.1616	−141	.1903	−205	1260
710	.1120	− 58	.1284	− 76	.1475	−104	.1698	−141	1278
720	.1062	− 48	.1208	− 62	.1371	− 81	.1557	−106	1296
730	.1014	− 41	.1146	− 52	.1290	− 66	.1451	− 84	1314
740	.09733	− 358	.1094	− 45	.1224	− 55	.1367	− 69	1332
750	.09375	− 317	.1049	− 39	.1169	− 48	.1298	− 58	1350
760	.09058	− 284	.1010	− 34	.1121	− 41	.1240	− 50	1368
770	.08774	− 256	.09757	− 308	.1080	− 37	.1190	− 44	1386
780	.08518	− 234	.09449	− 278	.1043	− 33	.1146	− 39	1404
790	.08284	− 214	.09171	− 253	.1010	− 30	.1107	− 34	1422
800	.08070	− 198	.08918	− 233	.09803	− 272	.1073	− 32	1440
810	.07872	− 184	.08685	− 214	.09531	− 248	.1041	− 28	1458
820	.07688	− 171	.08471	− 199	.09283	− 229	.1013	− 27	1476
830	.07517	− 160	.08272	− 185	.09054	− 213	.09862	− 243	1494
840	.07357	− 151	.08037	− 173	.08841	− 197	.09619	− 225	1512
850	.07206		.07914		.08644		.09394		1530

TABLE 3.- SPECIFIC HEAT C_p/R OF STEAM

°K	1 atm		10 atm		20 atm		40 atm		°R
380	4.462	-64							684
390	4.398	-43							702
400	4.355	-27							720
410	4.328	-16							738
420	4.312	-12							756
430	4.300	- 9							774
440	4.291	- 7							792
450	4.284	- 2							810
460	4.282		5.614	-216					828
470	4.282	3	5.398	-167					846
480	4.285	3	5.231	-132					864
490	4.288	6	5.099	-105	6.574	-363			882
500	4.294	7	4.994	- 84	6.211	-284			900
510	4.301	7	4.910	- 68	5.927	-224			918
520	4.308	9	4.842	- 54	5.703	-180			936
530	4.317	9	4.788	- 44	5.523	-145	8.041	-609	954
540	4.326	9	4.744	- 36	5.378	-118	7.432	-465	972
550	4.335	11	4.708	- 27	5.260	- 96	6.967	-365	990
560	4.346	11	4.681	- 22	5.164	- 79	6.602	-291	1008
570	4.357	10	4.659	- 18	5.085	- 66	6.311	-237	1026
580	4.367	12	4.641	- 13	5.019	- 54	6.074	-193	1044
590	4.379	12	4.628	- 10	4.965	- 44	5.881	-158	1062
600	4.391	13	4.618	- 7	4.921	- 37	5.723	-132	1080
610	4.404	12	4.611	- 5	4.884	- 30	5.591	-110	1098
620	4.416	13	4.606	- 2	4.854	- 25	5.481	- 92	1116
630	4.429	13	4.604	- 1	4.829	- 21	5.389	- 78	1134
640	4.442	12	4.603	1	4.808	- 16	5.311	- 65	1152
650	4.454	13	4.604	2	4.792	- 13	5.246	- 56	1170
660	4.467	14	4.606	4	4.779	- 9	5.190	- 46	1188
670	4.481	14	4.610	5	4.770	- 8	5.144	- 40	1206
680	4.495	13	4.615	5	4.762	- 5	5.104	- 34	1224
690	4.508	14	4.620	7	4.757	- 3	5.070	- 27	1242
700	4.522	13	4.627	7	4.754	- 2	5.043	- 25	1260
710	4.535	15	4.634	8	4.752		5.018	- 19	1278
720	4.550	14	4.642	9	4.752	2	4.999	- 16	1296
730	4.564	14	4.651	8	4.754	2	4.983	- 13	1314
740	4.578	14	4.659	10	4.756	4	4.970	- 11	1332
750	4.592	15	4.669	11	4.760	5	4.959	- 8	1350
760	4.607	14	4.680	10	4.765	5	4.951	- 8	1368
770	4.621	15	4.690	11	4.770	6	4.943	- 4	1386
780	4.636	14	4.701	11	4.776	8	4.939	- 2	1404
790	4.650	15	4.712	12	4.784	8	4.937		1422
800	4.665	15	4.724	12	4.792	8	4.937	1	1440
810	4.680	14	4.736	12	4.800	9	4.938	1	1458
820	4.694	15	4.748	12	4.809	9	4.939	2	1476
830	4.709	15	4.760	12	4.818	10	4.941	3	1494
840	4.724	15	4.772	13	4.828	10	4.944	5	1512
850	4.739	15	4.785	13	4.838	10	4.949	5	1530

TABLE 3.- SPECIFIC HEAT C_p/R OF STEAM - Concluded

°K	40 atm		60 atm		80 atm		100 atm		°R
530	8.041	-609							954
540	7.432	-465							972
550	6.967	-365	10.328	-1197					990
560	6.602	-291	9.131	-805					1008
570	6.311	-237	8.326	-601	12.503	-1929			1026
580	6.074	-193	7.725	-468	10.574	-1150			1044
590	5.881	-158	7.257	-371	9.424	-805	13.879	-2366	1062
600	5.723	-132	6.886	-301	8.619	-611	11.513	-1364	1080
610	5.591	-110	6.585	-247	8.008	-481	10.149	-934	1098
620	5.481	-92	6.338	-203	7.527	-386	9.215	-698	1116
630	5.389	-78	6.135	-169	7.141	-315	8.517	-547	1134
640	5.311	-65	5.966	-141	6.826	-258	7.970	-439	1152
650	5.246	-56	5.825	-121	6.568	-217	7.531	-359	1170
660	5.190	-46	5.704	-100	6.351	-179	7.172	-294	1188
670	5.144	-40	5.604	-86	6.172	-152	6.878	-244	1206
680	5.104	-34	5.518	-73	6.020	-127	6.634	-204	1224
690	5.070	-27	5.445	-62	5.893	-108	6.430	-171	1242
700	5.043	-25	5.383	-54	5.785	-95	6.259	-148	1260
710	5.018	-19	5.329	-45	5.690	-80	6.111	-124	1278
720	4.999	-16	5.284	-39	5.610	-68	5.987	-106	1296
730	4.983	-13	5.245	-34	5.542	-60	5.881	-92	1314
740	4.970	-11	5.211	-29	5.482	-50	5.789	-79	1332
750	4.959	-8	5.182	-24	5.432	-45	5.710	-69	1350
760	4.951	-8	5.158	-23	5.387	-41	5.641	-63	1368
770	4.943	-4	5.135	-17	5.346	-32	5.578	-50	1386
780	4.939	-2	5.118	-13	5.314	-27	5.528	-43	1404
790	4.937		5.105	-11	5.287	-23	5.485	-37	1422
800	4.937	1	5.094	-8	5.264	-19	5.448	-31	1440
810	4.938	1	5.086	-8	5.245	-18	5.417	-30	1458
820	4.939	2	5.078	-5	5.227	-14	5.387	-24	1476
830	4.941	3	5.073	-4	5.213	-12	5.363	-21	1494
840	4.944	5	5.069	-2	5.201	-9	5.342	-18	1512
850	4.949	5	5.067		5.192	-6	5.324	-15	1530

TABLE 4.- ENTHALPY[a] $(H - E_0^{\circ})/RT_0$ OF STEAM

°K	1 atm		10 atm		20 atm		40 atm		°R
380	5.482	162							684
390	5.644	160							702
400	5.804	159							720
410	5.963	158							738
420	6.121	158							756
430	6.279	157							774
440	6.436	157							792
450	6.593	157							810
460	6.750	157	6.306	201					828
470	6.907	156	6.507	195					846
480	7.063	157	6.702	189					864
490	7.220	157	6.891	184	6.432	233			882
500	7.377	158	7.075	182	6.665	222			900
510	7.535	157	7.257	178	6.887	213			918
520	7.692	158	7.435	176	7.100	206			936
530	7.850	158	7.611	175	7.306	199	6.528	283	954
540	8.008	159	7.786	173	7.505	195	6.811	263	972
550	8.167	159	7.959	172	7.700	190	7.074	248	990
560	8.326	159	8.131	171	7.890	188	7.322	236	1008
570	8.485	160	8.302	170	8.078	185	7.558	227	1026
580	8.645	160	8.472	169	8.263	183	7.785	219	1044
590	8.805	160	8.641	170	8.446	181	8.004	212	1062
600	8.965	161	8.811	168	8.627	179	8.216	207	1080
610	9.126	162	8.979	169	8.806	178	8.423	202	1098
620	9.288	162	9.148	169	8.984	177	8.625	199	1116
630	9.450	162	9.317	168	9.161	177	8.824	196	1134
640	9.612	163	9.485	169	9.338	175	9.020	193	1152
650	9.775	163	9.654	168	9.513	176	9.213	191	1170
660	9.938	164	9.822	169	9.689	174	9.404	189	1188
670	10.102	164	9.991	169	9.863	175	9.593	188	1206
680	10.266	165	10.160	169	10.038	174	9.781	186	1224
690	10.431	165	10.329	169	10.212	174	9.967	185	1242
700	10.596	166	10.498	170	10.386	174	10.152	184	1260
710	10.762	166	10.668	170	10.560	174	10.336	184	1278
720	10.928	167	10.838	170	10.734	174	10.520	183	1296
730	11.095	167	11.008	170	10.908	174	10.703	182	1314
740	11.262	168	11.178	171	11.082	174	10.885	181	1332
750	11.430	169	11.349	171	11.256	175	11.066	182	1350
760	11.599	169	11.520	171	11.431	174	11.248	181	1368
770	11.768	169	11.691	172	11.605	175	11.429	181	1386
780	11.937	170	11.863	173	11.780	175	11.610	181	1404
790	12.107	171	12.036	172	11.955	175	11.791	180	1422
800	12.278	171	12.208	173	12.130	176	11.971	181	1440
810	12.449	171	12.381	174	12.306	176	12.152	181	1458
820	12.620	172	12.555	174	12.482	176	12.333	181	1476
830	12.792	173	12.729	174	12.658	176	12.514	181	1494
840	12.965	173	12.903	175	12.834	177	12.695	181	1512
850	13.138		13.078		13.011		12.876		1530

[a]Enthalpy function divided here by a constant RT_0 where $T_0 = 273.16^{\circ}$ K (491.688° R).

TABLE 4.- ENTHALPY[a] $(H - E_0^\circ)/RT_0$ OF STEAM - Concluded

°K	40 atm		60 atm		80 atm		100 atm		°R
530	6.528	283							954
540	6.811	263							972
550	7.074	248	6.237	355					990
560	7.322	236	6.592	319					1008
570	7.558	227	6.911	293	6.051	420			1026
580	7.785	219	7.204	274	6.471	365			1044
590	8.004	212	7.478	258	6.836	329	6.000	462	1062
600	8.216	207	7.736	247	7.165	304	6.462	395	1080
610	8.432	202	7.983	236	7.469	284	6.857	353	1098
620	8.625	199	8.219	228	7.753	269	7.210	324	1116
630	8.824	196	8.447	222	8.022	255	7.534	302	1134
640	9.020	193	8.669	216	8.277	245	7.836	283	1152
650	9.213	191	8.885	210	8.522	236	8.119	269	1170
660	9.404	189	9.095	207	8.758	230	8.388	257	1188
670	9.593	188	9.302	204	8.988	223	8.645	247	1206
680	9.781	186	9.506	201	9.211	218	8.892	239	1224
690	9.967	185	9.707	198	9.429	213	9.131	233	1242
700	10.152	184	9.905	196	9.642	210	9.364	226	1260
710	10.336	184	10.101	194	9.852	207	9.590	221	1278
720	10.520	183	10.295	193	10.059	204	9.811	217	1296
730	10.703	182	10.488	191	10.263	202	10.028	214	1314
740	10.885	181	10.679	190	10.465	200	10.242	211	1332
750	11.066	182	10.869	190	10.665	198	10.453	207	1350
760	11.248	181	11.059	188	10.863	196	10.660	206	1368
770	11.429	181	11.247	188	11.059	195	10.866	203	1386
780	11.610	181	11.435	187	11.254	194	11.069	201	1404
790	11.791	180	11.622	186	11.448	193	11.270	200	1422
800	11.971	181	11.808	187	11.641	193	11.470	199	1440
810	12.152	181	11.995	186	11.834	191	11.669	198	1458
820	12.333	181	12.181	186	12.025	191	11.867	197	1476
830	12.514	181	12.367	185	12.216	191	12.064	196	1494
840	12.695	181	12.552	186	12.407	190	12.260	195	1512
850	12.876		12.738		12.597		12.455		1530

[a]Enthalpy function divided here by a constant RT_0 where $T_0 = 273.16^\circ$ K (491.688° R).

TABLE 5.- ENTROPY S/R OF STEAM

°K	1 atm		10 atm		20 atm		40 atm		°R
380	23.628	115							684
390	23.743	111							702
400	23.854	107							720
410	23.961	104							738
420	24.065	101							756
430	24.166	99							774
440	24.265	97							792
450	24.362	94							810
460	24.456	92	21.945	118					828
470	24.548	90	22.063	112					846
480	24.638	88	22.175	106					864
490	24.726	87	22.281	102	21.384	129			882
500	24.813	85	22.383	98	21.513	120			900
510	24.898	84	22.481	95	21.633	113			918
520	24.982	82	22.576	92	21.746	107			936
530	25.064	81	22.668	89	21.853	101	20.837	144	954
540	25.145	79	22.757	87	21.954	98	20.981	132	972
550	25.224	78	22.844	84	22.052	94	21.113	122	990
560	25.302	77	22.928	83	22.146	90	21.235	114	1008
570	25.379	76	23.011	81	22.236	88	21.349	108	1026
580	25.455	75	23.092	79	22.324	86	21.457	102	1044
590	25.530	74	23.171	78	22.410	83	21.559	98	1062
600	25.604	72	23.249	76	22.493	81	21.657	93	1080
610	25.676	72	23.325	75	22.574	79	21.750	90	1098
620	25.748	71	23.400	73	22.653	77	21.840	87	1116
630	25.819	70	23.473	73	22.730	76	21.927	84	1134
640	25.889	69	23.546	71	22.806	75	22.011	82	1152
650	25.958	68	23.617	71	22.881	73	22.093	80	1170
660	26.026	67	23.688	69	22.954	72	22.173	77	1188
670	26.093	66	23.757	68	23.026	70	22.250	76	1206
680	26.159	66	23.825	68	23.096	70	22.326	74	1224
690	26.225	65	23.893	66	23.166	68	22.400	73	1242
700	26.290	64	23.959	66	23.234	67	22.473	72	1260
710	26.354	64	24.025	65	23.301	67	22.545	70	1278
720	26.418	63	24.090	64	23.368	66	22.615	68	1296
730	26.481	62	24.154	63	23.434	64	22.683	68	1314
740	26.543	61	24.217	63	23.498	64	22.751	67	1332
750	26.604	61	24.280	62	23.562	63	22.818	65	1350
760	26.665	61	24.342	61	23.625	62	22.883	65	1368
770	26.726	60	24.403	60	23.687	62	22.948	64	1386
780	26.786	59	24.463	60	23.749	61	23.012	63	1404
790	26.845	58	24.523	60	23.810	60	23.075	62	1422
800	26.903	58	24.583	59	23.870	60	23.137	61	1440
810	26.961	58	24.642	58	23.930	59	23.198	61	1458
820	27.019	57	24.700	57	23.989	58	23.259	60	1476
830	27.076	56	24.757	57	24.047	58	23.319	59	1494
840	27.132	56	24.814	57	24.105	57	23.378	58	1512
850	27.188	55	24.871	56	24.162	56	23.436	58	1530

TABLE 5.- ENTROPY S/R OF STEAM - Concluded

°K	40 atm		60 atm		80 atm		100 atm		°R
530	20.837	144							954
540	20.981	132							972
550	21.113	122	20.364	175					990
560	21.235	114	20.539	155					1008
570	21.349	108	20.694	139	20.060	200			1026
580	21.457	102	20.833	128	20.260	170			1044
590	21.559	98	20.961	119	20.430	152	19.880	212	1062
600	21.657	93	21.080	111	20.582	137	20.092	178	1080
610	21.750	90	21.191	105	20.719	126	20.270	157	1098
620	21.840	87	21.296	100	20.845	117	20.427	142	1116
630	21.927	84	21.396	95	20.962	110	20.569	130	1134
640	22.011	82	21.491	91	21.072	104	20.699	120	1152
650	22.093	80	21.582	88	21.176	98	20.819	112	1170
660	22.173	77	21.670	85	21.274	95	20.931	106	1188
670	22.250	76	21.755	83	21.369	90	21.037	100	1206
680	22.326	74	21.838	80	21.459	87	21.137	95	1224
690	22.400	73	21.918	78	21.546	84	21.232	91	1242
700	22.473	72	21.996	76	21.630	81	21.323	88	1260
710	22.545	70	22.072	74	21.711	79	21.411	84	1278
720	22.615	68	22.146	72	21.790	77	21.495	82	1296
730	22.683	68	22.218	72	21.867	75	21.577	80	1314
740	22.751	67	22.290	69	21.942	73	21.657	77	1332
750	22.818	65	22.359	69	22.015	72	21.734	75	1350
760	22.883	65	22.428	67	22.087	70	21.809	73	1368
770	22.948	64	22.495	66	22.157	69	21.882	72	1386
780	23.012	63	22.561	65	22.226	68	21.954	70	1404
790	23.075	62	22.626	64	22.294	66	22.024	69	1422
800	23.137	61	22.690	64	22.360	65	22.093	67	1440
810	23.198	61	22.754	62	22.425	64	22.160	67	1458
820	23.259	60	22.816	62	22.489	64	22.227	65	1476
830	23.319	59	22.878	60	22.553	62	22.292	64	1494
840	23.378	58	22.938	60	22.615	61	22.356	63	1512
850	23.436	58	22.998	59	22.676	61	22.419	62	1530

TABLE 6.- FREE-ENERGY FUNCTION $-(F - E_0^o)/RT$ OF STEAM

°K	1 atm		10 atm		20 atm		40 atm		°R
380	19.687	103							684
390	19.790	100							702
400	19.890	98							720
410	19.988	96							738
420	20.084	94							756
430	20.178	92							774
440	20.270	89							792
450	20.359	88							810
460	20.447	87	18.200	81					828
470	20.534	84	18.281	80					846
480	20.618	83	18.361	79					864
490	20.701	82	18.440	78	17.798	74			882
500	20.783	79	18.518	77	17.872	72			900
510	20.862	79	18.595	75	17.944	71			918
520	20.941	77	18.670	75	18.015	73			936
530	21.018	76	18.745	73	18.088	70	17.472	64	954
540	21.094	74	18.818	73	18.158	70	17.536	63	972
550	21.168	73	18.891	71	18.228	69	17.599	64	990
560	21.241	72	18.962	70	18.297	69	17.663	64	1008
570	21.313	71	19.032	70	18.366	66	17.727	63	1026
580	21.384	69	19.102	68	18.432	67	17.790	63	1044
590	21.453	69	19.170	67	18.499	66	17.853	63	1062
600	21.522	67	19.237	67	18.565	65	17.916	63	1080
610	21.589	67	19.304	65	18.630	65	17.979	61	1098
620	21.656	66	19.369	65	18.695	63	18.040	61	1116
630	21.722	64	19.434	63	18.758	63	18.101	60	1134
640	21.786	64	19.497	63	18.821	61	18.161	60	1152
650	21.850	62	19.560	62	18.882	62	18.221	59	1170
660	21.912	62	19.622	61	18.944	60	18.280	59	1188
670	21.974	62	19.683	61	19.004	60	18.339	58	1206
680	22.036	60	19.744	60	19.064	59	18.397	58	1224
690	22.096	59	19.804	59	19.123	58	18.455	57	1242
700	22.155	59	19.863	58	19.181	58	18.512	56	1260
710	22.214	58	19.921	57	19.239	57	18.568	56	1278
720	22.272	57	19.978	57	19.296	56	18.624	55	1296
730	22.329	57	20.035	56	19.352	56	18.679	55	1314
740	22.386	55	20.091	55	19.408	55	18.734	54	1332
750	22.441	55	20.146	55	19.463	54	18.788	53	1350
760	22.496	55	20.201	54	19.517	53	18.841	52	1368
770	22.551	54	20.255	54	19.570	53	18.893	53	1386
780	22.605	53	20.309	53	19.623	53	18.946	52	1404
790	22.658	53	20.362	52	19.676	52	18.998	51	1422
800	22.711	52	20.414	52	19.728	51	19.049	51	1440
810	22.763	52	20.466	51	19.779	52	19.100	51	1458
820	22.815	51	20.517	51	19.831	50	19.151	49	1476
830	22.866	50	20.568	50	19.881	50	19.200	49	1494
840	22.916	50	20.618	50	19.931	49	19.249	49	1512
850	22.966		20.668		19.980		19.298		1530

TABLE 6.- FREE-ENERGY FUNCTION $-(F - E_0^o)/RT$ OF STEAM - Concluded

^oK	40 atm		60 atm		80 atm		100 atm		^oR
530	17.472	64							954
540	17.536	63							972
550	17.599	64	17.267	56					990
560	17.663	64	17.323	58					1008
570	17.727	63	17.381	59	17.161	51			1026
580	17.790	63	17.440	59	17.212	53			1044
590	17.853	63	17.499	59	17.265	54	17.102	48	1062
600	17.916	63	17.558	59	17.319	55	17.150	50	1080
610	17.979	61	17.617	58	17.374	55	17.200	51	1098
620	18.040	61	17.675	58	17.429	55	17.251	51	1116
630	18.101	60	17.733	58	17.484	55	17.302	52	1134
640	18.161	60	17.791	58	17.539	55	17.354	53	1152
650	18.221	59	17.849	57	17.594	56	17.407	52	1170
660	18.280	59	17.906	57	17.650	54	17.459	53	1188
670	18.339	58	17.963	56	17.704	55	17.512	52	1206
680	18.397	58	18.019	56	17.759	55	17.564	52	1224
690	18.455	57	18.075	56	17.814	53	17.616	53	1242
700	18.512	56	18.131	55	17.867	54	17.669	53	1260
710	18.568	56	18.186	54	17.921	53	17.722	52	1278
720	18.624	55	18.240	54	17.974	53	17.774	51	1296
730	18.679	55	18.294	54	18.027	53	17.825	51	1314
740	18.734	54	18.348	53	18.080	52	17.876	51	1332
750	18.788	53	18.401	52	18.132	51	17.927	51	1350
760	18.841	52	18.453	52	18.183	51	17.978	50	1368
770	18.893	53	18.505	52	18.234	50	18.028	49	1386
780	18.946	52	18.557	51	18.284	50	18.077	50	1404
790	18.998	51	18.608	50	18.334	50	18.127	49	1422
800	19.049	51	18.658	50	18.384	50	18.176	49	1440
810	19.100	51	18.708	50	18.434	49	18.225	49	1458
820	19.151	49	18.758	49	18.483	49	18.274	48	1476
830	19.200	49	18.807	49	18.532	48	18.322	47	1494
840	19.249	49	18.856	48	18.580	48	18.369	47	1512
850	19.298		18.904		18.628		18.416		1530

M

TABLE 7.- VISCOSITY η OF STEAM

[Values in poises $\times 10^{-5}$]

(a) At atmospheric pressure

°K	η		°R
[a]280	9.09	72	504
300	9.81	72	540
320	10.53	72	576
340	11.25	73	612
360	11.98	72	648
380	12.70	72	684
400	13.42	72	720
420	14.14	72	756
440	14.86	73	792
460	15.59	72	828
480	16.31	72	864
500	17.03	72	900
520	17.75	72	936
540	18.47	73	972
560	19.20	72	1008
580	19.92	72	1044
600	20.64	72	1080
620	21.36	72	1116
640	22.08	73	1152
660	22.81	72	1188
680	23.53	72	1224
700	24.25	72	1260
720	24.97	72	1296
740	25.69	73	1332
760	26.42	72	1368
780	27.14	72	1404
800	27.86	73	1440
820	28.59	73	1476
840	29.32	75	1512
860	30.07	78	1548
880	30.85	85	1584
900	31.70		1620

°K	η		°R
900	31.70	85	1620
920	32.55	84	1656
940	33.39	83	1692
960	34.22	82	1728
980	35.04	81	1764
1000	35.85	80	1800
1020	36.65	78	1836
1040	37.43	78	1872
1060	38.21	76	1908
1080	38.97	75	1944
1100	39.72	74	1980
1120	40.46	72	2016
1140	41.18	71	2052
1160	41.89	70	2088
1180	42.59	68	2124
1200	43.27	66	2160
1220	43.93	66	2196
1240	44.59	63	2232
1260	45.22	63	2268
1280	45.85	61	2304
1300	46.46	60	2340
1320	47.06	57	2376
1340	47.63	57	2412
1360	48.20	55	2448
1380	48.75	53	2484
1400	49.28	52	2520
1420	49.80	51	2556
1440	50.31	49	2592
1460	50.80	48	2628
1480	51.28	46	2664
1500	51.74		2700

[a]Entries below 373.16° K refer to viscosity of vapor near saturation pressure.

TABLE 7.- VISCOSITY η OF STEAM - Concluded

(b) At elevated pressures

°K	20 atm		40 atm		60 atm		80 atm		°R
500	17.17	178							900
550	18.95	180	19.14	176	19.45	167			990
600	20.75	179	20.90	177	21.12	170	21.42	164	1080
650	22.54	180	22.67	179	22.82	178	23.06	172	1170
700	24.34	181	24.46	179	24.60	178	24.78	175	1260
750	26.15	179	26.25	179	26.38	177	26.53	175	1350
800	27.94	184	28.04	183	28.15	182	28.28	181	1440
850	29.78	199	29.87	199	29.97	198	30.09	196	1530
900	31.77	210	31.86	209	31.95	208	32.05	204	1620
950	33.87	205	33.95	204	34.03	204	34.09	207	1710
1000	35.92	196	35.99	196	36.07	196	36.16	195	1800
1050	37.88	190	37.95	190	38.03	189	38.11	188	1890
1100	39.78		39.85		39.92		39.99		1980

°K	100 atm		200 atm		250 atm		300 atm		°R
600	21.87	147							1080
650	23.34	165	27.90	- 90					1170
700	24.99	171	27.00	127	29.29	2	34.01	-293	1260
750	26.70	173	28.27	136	29.31	108	31.08	42	1350
800	28.43	179	29.63	150	30.39	140	31.50	111	1440
850	30.22	195	31.13	182	31.79	171	32.61	153	1530
900	32.17	206	32.95	197	33.50	188	34.14	177	1620
950	34.23	202	34.92	194	35.38	188	35.91	180	1710
1000	36.25	195	36.86	189	37.26	184	37.71	178	1800
1050	38.20	188	38.75	182	39.10	179	39.49	176	1890
1100	40.08		40.57		40.89		41.25		1980

TABLE 8.- THERMAL CONDUCTIVITY k/k_0° OF STEAM

°K	0-atm limit		1 atm		4 atm		7 atm		°R
300	1.126	47							540
310	1.173	48							558
320	1.221	48							576
330	1.269	49							594
340	1.318	49							612
350	1.367	49							630
360	1.416	49							648
370	1.465	50							666
380	1.515	50	1.547	46					684
390	1.565	50	1.593	48					702
400	1.615	50	1.641	48					720
410	1.665	51	1.689	48					738
420	1.716	51	1.737	49	1.809	41			756
430	1.767	51	1.786	49	1.850	43			774
440	1.818	52	1.835	50	1.893	45	1.962	37	792
450	1.870	51	1.885	50	1.938	47	1.999	42	810
460	1.921	52	1.935	51	1.985	47	2.041	42	828
470	1.973	52	1.986	51	2.032	46	2.083	41	846
480	2.025	52	2.037	51	2.078	47	2.124	42	864
490	2.077	52	2.088	51	2.125	47	2.166	42	882
500	2.129	52	2.139	51	2.172	49	2.208	47	900
510	2.181	52	2.190	52	2.221	50	2.255	47	918
520	2.233	53	2.242	52	2.271	49	2.302	46	936
530	2.286	52	2.294	52	2.320	49	2.348	47	954
540	2.338	53	2.346	52	2.369	50	2.395	47	972
550	2.391	53	2.398	52	2.419	51	2.442	50	990
560	2.444	52	2.450	52	2.470	51	2.492	50	1008
570	2.496	53	2.502	53	2.521	52	2.542	49	1026
580	2.549	53	2.555	53	2.573	51	2.591	50	1044
590	2.602	53	2.608	52	2.624	51	2.641	50	1062
600	2.655	54	2.660	53	2.675	52	2.691	51	1080
610	2.709	53	2.713	53	2.727	52	2.742	51	1098
620	2.762	53	2.766	53	2.779	53	2.793	52	1116
630	2.815	53	2.819	53	2.832	52	2.845	51	1134
640	2.868	54	2.872	53	2.884	52	2.896	51	1152
650	2.922	53	2.925	54	2.936	53	2.947	52	1170
660	2.975	54	2.979	53	2.989	53	2.999	52	1188
670	3.029	53	3.032	53	3.042	52	3.051	53	1206
680	3.082	54	3.085	54	3.094	53	3.104	52	1224
690	3.136	54	3.139	53	3.147	53	3.156	52	1242
700	3.190	53	3.192	53	3.200	53	3.208	53	1260
710	3.243	54	3.245	54	3.253	53	3.261	53	1278
720	3.297	54	3.299	54	3.306	54	3.314	52	1296
730	3.351	53	3.353	53	3.360	53	3.366	53	1314
740	3.404	54	3.406	54	3.413	53	3.419	53	1332
750	3.458	54	3.460	54	3.466	53	3.472	53	1350
760	3.512	54	3.514	53	3.519	54	3.525	54	1368
770	3.566	53	3.567	54	3.573	53	3.579	53	1386
780	3.619	54	3.621	54	3.626	54	3.632	53	1404
790	3.673	53	3.675	53	3.680	53	3.685	52	1422
800	3.726		3.728		3.733		3.737		1440

TABLE 8.- THERMAL CONDUCTIVITY k/k_0° OF STEAM - Concluded

°K	10 atm		40 atm		70 atm		100 atm		°R
450	2.069	31							810
460	2.100	33							828
470	2.133	36							846
480	2.169	38							864
490	2.207	41							882
500	2.248	43							900
510	2.291	44							918
520	2.335	44							936
530	2.379	44							954
540	2.423	44							972
550	2.467	48	2.842	6	3.602	-110			990
560	2.515	49	2.848	13	3.492	- 80			1008
570	2.564	48	2.861	18	3.412	- 57			1026
580	2.612	48	2.879	23	3.355	- 39			1044
590	2.660	48	2.902	26	3.316	- 25	4.020	-132	1062
600	2.708	50	2.928	29	3.291	- 11	3.888	-100	1080
610	2.758	50	2.957	34	3.280	- 6	3.788	- 75	1098
620	2.808	50	2.991	34	3.274	4	3.713	- 53	1116
630	2.858	51	3.025	37	3.278	11	3.660	- 38	1134
640	2.909	50	3.062	39	3.289	16	3.622	- 24	1152
650	2.959	52	3.101	43	3.305	21	3.598	- 13	1170
660	3.011	51	3.144	42	3.326	24	3.585	- 4	1188
670	3.062	52	3.186	43	3.350	28	3.581	3	1206
680	3.114	51	3.229	42	3.378	31	3.584	10	1224
690	3.165	51	3.271	43	3.409	33	3.594	15	1242
700	3.216	53	3.314	47	3.442	35	3.609	20	1260
710	3.269	52	3.361	47	3.477	37	3.629	23	1278
720	3.321	53	3.408	46	3.514	39	3.652	26	1296
730	3.374	52	3.454	47	3.553	40	3.678	30	1314
740	3.426	52	3.501	47	3.593	41	3.708	32	1332
750	3.478	53	3.548	49	3.634	42	3.740	34	1350
760	3.531	53	3.597	49	3.676	43	3.774	36	1368
770	3.584	52	3.646	50	3.719	44	3.810	37	1386
780	3.636	53	3.696	49	3.763	45	3.847	39	1404
790	3.689	52	3.745	49	3.808	47	3.886	40	1422
800	3.741		3.794		3.855		3.926		1440

°K	150 atm		200 atm		250 atm		300 atm		°R
620	5.042	-272							1116
630	4.770	-211							1134
640	4.559	-162	6.338	-482					1152
650	4.397	-126	5.856	-376	8.522	-911	13.388	-2020	1170
660	4.271	- 97	5.480	-294	7.611	-700	11.368	-1516	1188
670	4.174	- 72	5.186	-229	6.911	-539	9.852	-1141	1206
680	4.102	- 54	4.957	-179	6.372	-422	8.711	- 877	1224
690	4.048	- 38	4.778	-141	5.950	-332	7.834	- 680	1242
700	4.010	- 26	4.637	-110	5.618	-262	7.154	- 532	1260
710	3.984	- 15	4.527	- 85	5.356	-208	6.622	- 421	1278
720	3.969	- 6	4.442	- 64	5.148	-164	6.201	- 331	1296
730	3.963	1	4.378	- 48	4.984	-130	5.870	- 266	1314
740	3.964	7	4.330	- 34	4.854	-102	5.604	- 212	1332
750	3.971	13	4.296	- 22	4.752	- 79	5.392	- 166	1350
760	3.984	17	4.274	- 14	4.673	- 61	5.226	- 135	1368
770	4.001	21	4.260	- 5	4.612	- 45	5.091	- 107	1386
780	4.022	24	4.255	2	4.567	- 16	4.984	- 83	1404
790	4.046	27	4.257	7	4.551	- 38	4.901	- 65	1422
800	4.073		4.264		4.513		4.836		1440

TABLE 9.- SPECIFIC HEAT, ENTHALPY,[a] FREE-ENERGY FUNCTION, AND ENTROPY

OF STEAM IN IDEAL-GAS STATE

$^{\circ}K$	$\frac{C_p{}^{\circ}}{R}$		$\frac{H^{\circ} - E_0{}^{\circ}}{RT_0}$		$\frac{-(F^{\circ} - E_0{}^{\circ})}{RT}$		$\frac{S^{\circ}}{R}$		$^{\circ}R$
50	4.0072	-9	.7149	1467	11.6321	7137	15.5379	7305	90
60	4.0063	-4	.8616	1467	12.3458	6056	16.2684	6176	108
70	4.0059	-2	1.0083	1466	12.9514	5260	16.8860	5349	126
80	4.0057		1.1549	1467	13.4774	4649	17.4209	4718	144
90	4.0057	1	1.3016	1466	13.9423	4165	17.8927	4220	162
100	4.0058	2	1.4482	1467	14.3588	3773	18.3147	3819	180
110	4.0060	2	1.5949	1466	14.7361	3448	18.6966	3485	198
120	4.0062	3	1.7415	1467	15.0809	3174	19.0451	3207	216
130	4.0065	3	1.8882	1467	15.3983	2941	19.3658	2969	234
140	4.0068	4	2.0349	1466	15.6924	2740	19.6627	2765	252
150	4.0072	4	2.1815	1468	15.9664	2565	19.9392	2586	270
160	4.0076	4	2.3283	1467	16.2229	2410	20.1978	2430	288
170	4.0080	6	2.4750	1467	16.4639	2274	20.4408	2291	306
180	4.0086	7	2.6217	1468	16.6913	2152	20.6699	2167	324
190	4.0093	9	2.7685	1468	16.9065	2042	20.8866	2057	342
200	4.0102	11	2.9153	1468	17.1107	1943	21.0923	1957	360
210	4.0113	14	3.0621	1469	17.3050	1853	21.2880	1866	378
220	4.0127	18	3.2090	1469	17.4903	1771	21.4746	1784	396
230	4.0145	21	3.3559	1470	17.6674	1697	21.6530	1709	414
240	4.0166	25	3.5029	1471	17.8371	1627	21.8239	1641	432
250	4.0191	30	3.6500	1472	17.9998	1565	21.9880	1577	450
260	4.0221	36	3.7972	1473	18.1563	1506	22.1457	1518	468
270	4.0257	40	3.9445	1474	18.3069	1451	22.2975	1465	486
280	4.0297	46	4.0919	1476	18.4520	1401	22.4440	1415	504
290	4.0343	51	4.2395	1478	18.5921	1354	22.5855	1368	522
300	4.0394	57	4.3873	1480	18.7275	1311	22.7223	1326	540
310	4.0451	63	4.5353	1482	18.8586	1269	22.8549	1285	558
320	4.0514	68	4.6835	1484	18.9855	1230	22.9834	1248	576
330	4.0582	73	4.8319	1487	19.1085	1194	23.1082	1212	594
340	4.0655	78	4.9806	1490	19.2279	1161	23.2294	1180	612
350	4.0733	83	5.1296	1493	19.3440	1128	23.3474	1148	630
360	4.0816	88	5.2789	1495	19.4568	1097	23.4622	1120	648
370	4.0904	92	5.4284	1500	19.5665	1069	23.5742	1092	666
380	4.0996	96	5.5784	1502	19.6734	1042	23.6834	1066	684
390	4.1092	100	5.7286	1506	19.7776	1017	23.7900	1042	702
400	4.1192	547	5.8792	7589	19.8793	4737	23.8942	4882	720
450	4.1739	606	6.6381	7695	20.3530	4254	24.3824	4429	810
500	4.2345	644	7.4076	7809	20.7784	3866	24.8253	4066	900
550	4.2989	670	8.1885	7930	21.1650	3548	25.2319	3769	990
600	4.3659	691	8.9815	8055	21.5198	3282	25.6088	3522	1080
650	4.4350	709	9.7870	8182	21.8480	3058	25.9610	3312	1170
700	4.5059	726	10.6052	8314	22.1538	2864	26.2922	3134	1260
750	4.5785	740	11.4366	8448	22.4402	2697	26.6056	2978	1350
800	4.6525	753	12.2814	8585	22.7099	2551	26.9034	2843	1440
850	4.7278	760	13.1399	8723	22.9650	2422	27.1877	2724	1530
900	4.8038	766	14.0122	8863	23.2072	2308	27.4601	2618	1620
950	4.8804	765	14.8985	9004	23.4380	2205	27.7219	2523	1710
1000	4.9569	761	15.7989	9143	23.6585	2114	27.9742	2436	1800
1050	5.0330	754	16.7132	9281	23.8699	2030	28.2178	2359	1890
1100	5.1084	742	17.6413	9419	24.0729	1955	28.4537	2287	1980
1150	5.1826	729	18.5832	9553	24.2684	1885	28.6824	2222	2070

[a]Enthalpy function divided here by a constant RT_0 where $T_0 = 273.16^{\circ}$ K (491.688° R).

TABLE 9.- SPECIFIC HEAT, ENTHALPY,[a] FREE-ENERGY FUNCTION, AND ENTROPY

OF STEAM IN IDEAL-GAS STATE - Concluded

°K	$\frac{C_p^\circ}{R}$		$\frac{H^\circ - E_0^\circ}{RT_0}$		$\frac{-(F^\circ - E_0^\circ)}{RT}$		$\frac{S^\circ}{R}$		°R
1200	5.2555	1405	19.5385	19499	24.4569	3587	28.9046	4262	2160
1300	5.3960	1326	21.4884	19999	24.8156	3371	29.3308	4048	2340
1400	5.5286	1240	23.4883	20470	25.1527	3185	29.7356	3857	2520
1500	5.6526	1152	25.5353	20907	25.4712	3022	30.1213	3686	2700
1600	5.7678	1065	27.6260	21312	25.7734	2879	30.4899	3529	2880
1700	5.8743	982	29.7572	21688	26.0613	2751	30.8428	3386	3060
1800	5.9725	903	31.9260	22031	26.3364	2636	31.1814	3253	3240
1900	6.0628	832	34.1291	22350	26.6000	2532	31.5067	3132	3420
2000	6.1460	764	36.3641	22641	26.8532	2438	31.8199	3017	3600
2100	6.2224	704	38.6282	22910	27.0970	2350	32.1216	2911	3780
2200	6.2928	648	40.9192	23158	27.3320	2271	32.4127	2812	3960
2300	6.3576	598	43.2350	23385	27.5591	2196	32.6939	2718	4140
2400	6.4174	553	45.5735	23596	27.7787	2128	32.9657	2631	4320
2500	6.4727	511	47.9331	23789	27.9915	2063	33.2288	2549	4500
2600	6.5238	474	50.3120	23971	28.1978	2004	33.4837	2471	4680
2700	6.5712	441	52.7091	24139	28.3982	1948	33.7308	2398	4860
2800	6.6153	410	55.1230	24293	28.5930	1894	33.9706	2329	5040
2900	6.6563	382	57.5523	24439	28.7824	1845	34.2035	2263	5220
3000	6.6945	691	59.9962	49273	28.9669	3552	34.4298	4343	5400
3200	6.7636	608	64.9235	49748	29.3221	3382	34.8641	4119	5760
3400	6.8244	538	69.8983	50168	29.6603	3229	35.2760	3916	6120
3600	6.8782	481	74.9151	50539	29.9832	3091	35.6676	3732	6480
3800	6.9263	431	79.9690	50872	30.2923	2964	36.0408	3564	6840
4000	6.9694	389	85.0562	51173	30.5887	2848	36.3972	3410	7200
4200	7.0083	353	90.1735	51444	30.8735	2740	36.7382	3269	7560
4400	7.0436	322	95.3179	51691	31.1475	2642	37.0651	3138	7920
4600	7.0758	295	100.4870	51917	31.4117	2550	37.3789	3018	8280
4800	7.1053	272	105.6787	52124	31.6667	2464	37.6807	2906	8640
5000	7.1325		110.8911		31.9131		37.9713		9000

[a]Enthalpy function divided here by a constant RT_0 where $T_0 = 273.16^\circ$ K (491.688° R).

TABLE 10.- VALUES OF GAS CONSTANT R FOR STEAM

For density in -	Value of R			
	For pressure in -			
	atm	kg/cm^2	mm Hg	lb/sq in.
For temperatures in $^{\circ}K$				
g/cm^3	4.55466	4.70600	3,461.54	66.9353
$mole/cm^3$	82.0567	84.7832	62,363.1	1,205.91
mole/liter	.0820544	.0847809	62.3613	1.20587
lb/cu ft	.0729579	.0753821	55.4480	1.07219
lb mole/cu ft	1.31441	1.35808	998.952	19.3166
For temperatures in $^{\circ}R$				
g/cm^3	2.53037	2.61444	1,923.08	37.1863
$mole/cm^3$	45.5871	47.1018	34,646.2	669.950
mole/liter	.0455858	.0471005	34.6452	.669928
lb/cu ft	.0405322	.0418789	30.8044	.595661
lb mole/cu ft	.730228	.754489	554.973	10.7314

TABLE 11.- CONVERSION FACTORS FOR TABLES 2 TO 9

[Molecular weight of steam is 18.016 g $mole^{-1}$. Unless otherwise specified, the mole is the gram-mole, the calorie is the thermochemical calorie, and the joule is the absolute joule.]

(a) For table 2

To convert tabulated value of	To	Having the dimensions indicated below	Multiply by
ρ in g cm^{-3}	ρ	mole cm^{-3}	0.055506
		g $liter^{-1}$	1.00003×10^{3}
		lb $in.^{-3}$	3.61275×10^{-2}
		lb ft^{-3}	62.4283

(b) For table 7

To convert tabulated value of	To	Having the dimensions indicated below	Multiply by
η in poises	η	kg hr^{-1} m^{-1}	3.6000×10^{2}
or g sec^{-1} cm^{-1}		slug hr^{-1} ft^{-1}	7.5188
		lb sec^{-1} ft^{-1}	6.7197×10^{-2}
		lb hr^{-1} ft^{-1}	2.4191×10^{2}

(c) For table 8

To convert tabulated value of	To	Having the dimensions indicated below	Multiply by
k/k_0°	k	cal cm^{-1} sec^{-1} $^{\circ}K^{-1}$	3.789×10^{-5}
		Btu ft^{-1} hr^{-1} $^{\circ}R^{-1}$	9.160×10^{-3}
		w cm^{-1} $^{\circ}K^{-1}$	1.585×10^{-4}

TABLE 11.- CONVERSION FACTORS FOR TABLES 2 TO 9 - Concluded

(d) For tables 4 and 9

To convert tabulated value of	To	Having the dimensions indicated below	Multiply by
$\left(H^{o} - E_{0}^{o}\right)/RT_{0}$,	$H^{o} - E_{0}^{o}$,	cal $mole^{-1}$	542.821
$\left(H - E_{0}^{o}\right)/RT$	$H - E_{0}^{o}$	cal g^{-1}	30.1299
		j g^{-1}	126.064
		Btu $(lb\ mole)^{-1}$	976.437
		Btu lb^{-1}	54.1983

(e) For tables 3, 5, 6, and 9

To convert tabulated value of	To	Having the dimensions indicated below	Multiply by
C_{p}^{o}/R, S^{o}/R,	C_{p}^{o}, S^{o},	cal $mole^{-1}$ $^{o}K^{-1}$ (or $^{o}C^{-1}$)	1.98719
C_{p}/R, S/R,	C_{p}, S,	cal g^{-1} $^{o}K^{-1}$ (or $^{o}C^{-1}$)	.110301
$-\left(F^{o} - E_{0}^{o}\right)/RT$,	$-\left(F^{o} - E_{0}^{o}\right)/T$,	j g^{-1} $^{o}K^{-1}$ (or $^{o}C^{-1}$)	.461500
$-\left(F - E_{0}^{o}\right)/RT$	$-\left(F - E_{0}^{o}\right)/T$	Btu $(lb\ mole)^{-1}$ $^{o}R^{-1}$ (or $^{o}F^{-1}$)	1.98588
		Btu lb^{-1} $^{o}R^{-1}$ (or $^{o}F^{-1}$)	.110229

TABLE 12.- GENERAL CONVERSION FACTORS

[General conversion factors taken from ref. 41]

(a) For units of length

Multiply by appropriate entry ↓ to obtain →	cm	mm	μ	mμ	A
1 cm	1	10	10^4	10^7	10^8
1 mm	10^{-1}	1	10^3	10^6	10^7
1 μ	10^{-4}	10^{-3}	1	10^3	10^4
1 mμ	10^{-7}	10^{-6}	10^{-3}	1	10
1 A	10^{-8}	10^{-7}	10^{-4}	10^{-1}	1
Multiply by appropriate entry ↓ to obtain →	**cm**	**m**	**in.**	**ft**	**yd**
1 cm	1	0.01	0.3937	0.032808333	0.010936111
1 m	100	1	39.37	3.2808333	1.0936111
1 in.	2.5400051	0.025400051	1	0.083333333	0.027777778
1 ft	30.480061	0.30480061	12	1	0.333333333
1 yd	91.440183	0.91440183	36	3	1

TABLE 12.- GENERAL CONVERSION FACTORS - Continued

(b) For units of area

Multiply by appropriate entry ↓ to obtain →	cm^2	m^2	sq in.	sq ft	sq yd
1 cm^2	1	10^{-4}	0.15499969	1.0763867×10^{-3}	1.1959853×10^{-4}
1 m^2	10^4	1	1,549.9969	10.763867	1.1959853
1 sq in.	6.4516258	6.4516258×10^{-4}	1	6.9444444×10^{-3}	7.7160494×10^{-4}
1 sq ft	929.03412	0.092903412	144	1	0.11111111
1 sq yd	8,361.3070	0.83613070	1,296	9	1

TABLE 12.- GENERAL CONVERSION FACTORS - Continued

(c) For units of volume

Multiply by appropriate entry ↓ to obtain →	ml	liter	gal
1 cm^3	0.9999720	0.9999720×10^{-3}	2.6417047×10^{-4}
1 cu in.	16.38670	1.638670×10^{-2}	4.3290043×10^{-3}
1 cu ft	28,316.22	28.31622	7.4805195
1 ml	1	0.001	2.641779×10^{-4}
1 liter	1,000	1	0.2641779
1 gal	3,785.329	3.785329	1

Multiply by appropriate entry ↓ to obtain →	cm^3	cu in.	cu ft
1 cm^3	1	0.061023378	3.5314455×10^{-5}
1 cu in.	16.387162	1	5.7870370×10^{-4}
1 cu ft	28,317.017	1,728	1
1 ml	1.000028	0.06102509	3.531544×10^{-5}
1 liter	1,000.028	61.02509	0.03531544
1 gal	3,785.4345	231	0.13368056

TABLE 12.- GENERAL CONVERSION FACTORS - Continued

(d) For units of mass

Multiply by appropriate entry ↓ to obtain →	g	kg	lb	metric ton	ton
1 g	1	10^{-3}	2.2046223×10^{-3}	10^{-6}	1.1023112×10^{-6}
1 kg	10^{3}	1	2.2046223	10^{-3}	1.1023112×10^{-3}
1 lb	453.59243	0.45359243	1	4.5359243×10^{-4}	0.0005
1 metric ton	10^{6}	10^{3}	2,204.6223	1	1.1023112
1 ton	907,184.86	907.18486	2,000	0.90718486	1

(e) For units of density

Multiply by appropriate entry ↓ to obtain →	g/cm^3	g/ml	lb/cu in.	lb/cu ft	lb/gal
1 g/cm^3	1	1.000028	0.036127504	62.428327	8.3454535
1 g/ml	0.9999720	1	0.03612649	62.42658	8.345220
1 lb/cu in.	27.679742	27.68052	1	1,728	231
1 lb/cu ft	0.016018369	0.01601882	5.7870370×10^{-4}	1	0.13368056
1 lb/gal	0.11982572	0.1198291	4.3290043×10^{-3}	7.4805195	1

TABLE 12.- GENERAL CONVERSION FACTORS - Continued

(f) For units of pressure

Multiply by appropriate entry to obtain → ↓	dyne/cm^2	bar	atm	kg(wt.)/cm^2	mm Hg	in. Hg	lb(wt.)/sq in.
1 dyne/cm^2	1	10^{-6}	0.9869233×10^{-6}	1.0197162×10^{-6}	7.500617×10^{-4}	2.952993×10^{-5}	1.4503830×10^{-5}
1 bar	10^6	1	0.9869233	1.0197162	750.0617	29.52993	14.503830
1 atm	1,013,250	1.013250	1	1.0332275	760	29.92120	14.696006
1 kg(wt.)/cm^2	980,665	0.980665	0.9678411	1	735.5592	28.95897	14.223398
1 mm Hg	1,333.2237	1.3332237×10^{-3}	1.3157895×10^{-3}	1.3595098×10^{-3}	1	0.03937	0.019336850
1 in. Hg	33,863.95	0.03386395	0.03342112	0.03453162	25.40005	1	0.4911570
1 lb(wt.)/sq in.	68,947.31	0.06894731	0.06804570	0.07030669	51.71473	2.036009	1

TABLE 12.- GENERAL CONVERSION FACTORS - Continued

(g) For units of energy

Multiply by appropriate entry ↓ to obtain →	g mass (energy equiv.)	abs. j	int. j	cal	I. T.[a] cal	Btu	int. kw-hr	hp-hr	ft-lb(wt.)	cu ft - lb(wt.)/sq in.	liter-atm
1 g mass (energy equiv.)	1	8.98656×10^{13}	8.98508×10^{13}	2.14784×10^{13}	2.14644×10^{13}	8.51775×10^{10}	2.49586×10^{7}	3.34754×10^{7}	6.62814×10^{13}	4.60287×10^{11}	8.86880×10^{11}
1 abs. j	1.112772×10^{-14}	1	0.999835	0.239006	0.238849	0.947831×10^{-3}	2.77732×10^{-7}	3.72505×10^{-7}	0.737561	5.12195×10^{-3}	9.86896×10^{-3}
1 int. j	1.112956×10^{-14}	1.000165	1	0.239045	0.238889	0.947988×10^{-3}	2.777778×10^{-7}	3.72567×10^{-7}	0.737682	5.12279×10^{-3}	9.87058×10^{-3}
1 cal	4.65584×10^{-14}	4.1840	4.1833	1	0.999346	3.96573×10^{-3}	1.162030×10^{-6}	1.558562×10^{-6}	3.08595	2.14302×10^{-2}	4.12917×10^{-2}
1 I. T.[a] cal	4.65888×10^{-14}	4.18674	4.18605	1.000654	1	3.96832×10^{-3}	1.162791×10^{-6}	1.559582×10^{-6}	3.08797	2.14443×10^{-2}	4.13187×10^{-2}
1 Btu	1.174019×10^{-11}	1,055.040	1,054.866	252.161	251.996	1	2.93018×10^{-4}	3.93008×10^{-4}	778.156	5.40386	10.41215
1 int. kw-hr	4.00664×10^{-8}	3,600,594	3,600,000	860,563	860,000	3,412.76	1	1.341241	2,655,656	18,442.06	35,534.1
1 hp-hr	2.98727×10^{-8}	2,684,525	2,684,082	641,617	641,197	2,544.48	0.745578	1	1,980,000	13,750	26,493.5
1 ft-lb(wt.)	1.508720×10^{-14}	1.355821	1.355597	0.324049	0.323837	1.285089×10^{-3}	3.76555×10^{-7}	5.05051×10^{-7}	1	6.94444×10^{-3}	1.338054×10^{-2}
1 cu ft - lb(wt.)/sq in.	2.17256×10^{-12}	195.2382	195.2060	46.6630	46.6325	0.1850529	5.42259×10^{-5}	7.27273×10^{-5}	144	1	1.926797
1 liter-atm	1.127548×10^{-12}	101.3278	101.3111	24.2179	24.2021	0.0960417	2.81420×10^{-5}	3.77452×10^{-5}	74.7354	5.18996	1

[a]I. T., International Steam Tables.

TABLE 12.- GENERAL CONVERSION FACTORS - Continued

(h) For units of molecular energy

Multiply by appropriate entry to obtain → ↓	erg/molecule	abs. j/mole	int. j/mole	cal/mole	abs. electron-v/molecule	int. electron-v/molecule	wave number (cm^{-1})
1 erg/molecule	1	6.02283×10^{16}	6.02184×10^{16}	1.439491×10^{16}	6.24222×10^{11}	6.24017×10^{11}	5.03581×10^{15}
1 abs. j/mole	1.660349×10^{-17}	1	0.999835	0.239006	1.036427×10^{-5}	1.036086×10^{-5}	8.36121×10^{-2}
1 int. j/mole	1.660623×10^{-17}	1.000165	1	0.239046	1.036599×10^{-5}	1.036257×10^{-5}	8.36259×10^{-2}
1 cal/mole	6.94690×10^{-17}	4.18400	4.1833	1	4.33641×10^{-5}	4.33498×10^{-5}	0.349833
1 abs. electron-v/molecule	1.601992×10^{-12}	96,485.3	96,469.4	23,060.5	1	0.999670	8,067.34
1 int. electron-v/molecule	1.602521×10^{-12}	96,517.1	96,501.2	23,068.1	1.000330	1	8,070.00
1 wave number (cm^{-1})	1.985776×10^{-16}	11.95999	11.95802	2.85851	1.239567×10^{-4}	1.239158×10^{-4}	1

TABLE 12.- GENERAL CONVERSION FACTORS - Continued

(i) For units of specific energy

Multiply by appropriate entry ↓ to obtain →	abs. j/g	int. j/g	cal/g	I. T.[a] cal/g	Btu/lb
1 abs. j/g	1	0.999835	0.239006	0.238849	0.429929
1 int. j/g	1.000165	1	0.239045	0.238889	0.430000
1 cal/g	4.1840	4.1833	1	0.999346	1.798823
1 I. T.[a] cal/g	4.18674	4.18605	1.000654	1	1.8
1 Btu/lb	2.32597	2.32558	0.555919	0.555556	1

[a]I. T., International Steam Tables.

(j) For units of specific energy per degree

Multiply by appropriate entry ↓ to obtain →	abs. j/g °C	int. j/g °C	cal/g °C	I. T.[a] cal/g °C	Btu/lb °F
1 abs. j/g °C	1	0.999835	0.239006	0.238849	0.238849
1 int. j/g °C	1.000165	1	0.239045	0.238889	0.238889
1 cal/g °C	4.1840	4.1833	1	0.999346	0.999346
1 I. T.[a] cal/g °C	4.18674	4.18605	1.000654	1	1
1 Btu/lb °F	4.18674	4.18605	1.000654	1	1

[a]I. T., International Steam Tables.

TABLE 12.- GENERAL CONVERSION FACTORS - Concluded

(k) For units of viscosity[b]

Multiply by appropriate entry to obtain → ↓	Centipoise	Poise	g_F sec cm^{-2}	lb_F sec in.$^{-2}$	lb_F sec ft^{-2}	lb_F hr in.$^{-2}$	lb_F hr ft^{-2}	g_M sec^{-1} cm^{-1}	lb_M sec^{-1} in.$^{-1}$	lb_M hr^{-1} ft^{-1}	slug sec^{-1} in.$^{-1}$	slug hr^{-1} ft^{-1}
Centipoise	1	1×10^{-2}	1.0197×10^{-5}	1.4504×10^{-7}	2.0886×10^{-5}	4.0289×10^{-11}	5.8016×10^{-9}	1×10^{-2}	5.5998×10^{-5}	2.4191	1.7405×10^{-6}	7.5188×10^{-2}
Poise	1×10^{2}	1	1.0197×10^{-3}	1.4504×10^{-5}	2.0886×10^{-3}	4.0289×10^{-9}	5.8016×10^{-7}	1	5.5998×10^{-3}	2.4191×10^{2}	1.7405×10^{-4}	7.5188
g_F sec cm^{-2}	9.8067×10^{4}	9.8067×10^{2}	1	1.4224×10^{-2}	2.0482	3.9510×10^{-6}	5.6895×10^{-4}	9.8067×10^{2}	5.4916	2.3725×10^{5}	1.7068×10^{-1}	7.3735×10^{3}
lb_F sec in.$^{-2}$	6.8947×10^{6}	6.8947×10^{4}	7.0305×10^{1}	1	1.4400×10^{2}	2.7778×10^{-4}	4.0000×10^{-2}	6.8947×10^{4}	3.8609×10^{2}	1.6679×10^{7}	1.2000×10	5.1840×10^{5}
lb_F sec ft^{-2}	4.7880×10^{4}	4.7880×10^{2}	4.8823×10^{-1}	6.9445×10^{-3}	1	1.9290×10^{-6}	2.7778×10^{-4}	4.7880×10^{2}	2.6812	1.1583×10^{5}	8.3333×10^{-2}	3.6000×10^{3}
lb_F hr in.$^{-2}$	2.4821×10^{10}	2.4821×10^{8}	2.5310×10^{5}	3.6000×10^{3}	5.1841×10^{5}	1	1.4400×10^{2}	2.4821×10^{8}	1.3899×10^{6}	6.0044×10^{10}	4.3199×10^{4}	1.8662×10^{9}
lb_F hr ft^{-2}	1.7237×10^{8}	1.7237×10^{6}	1.7577×10^{3}	2.5001×10^{1}	3.6001×10^{3}	6.9446×10^{-3}	1	1.7237×10^{6}	9.6524×10^{3}	4.1698×10^{8}	3.0000×10^{2}	1.2960×10^{7}
g_M sec^{-1} cm^{-1}	1×10^{2}	1	1.0197×10^{-3}	1.4504×10^{-5}	2.0886×10^{-3}	4.0289×10^{-9}	5.8016×10^{-7}	1	5.5998×10^{-3}	2.4191×10^{2}	1.7405×10^{-4}	7.5188
lb_M sec^{-1} in.$^{-1}$	1.7858×10^{4}	1.7858×10^{2}	1.8210×10^{-1}	2.5901×10^{-3}	3.7298×10^{-1}	7.1948×10^{-7}	1.0360×10^{-4}	1.7858×10^{2}	1	4.3200×10^{4}	3.1081×10^{-2}	1.3427×10^{3}
lb_M sec^{-1} ft^{-1}	1.4882×10^{3}	1.4882×10^{1}	1.5175×10^{-2}	2.1585×10^{-4}	3.1083×10^{-2}	5.9958×10^{-8}	8.6339×10^{-6}	1.4882×10	8.3333×10^{-2}	3.6000×10^{3}	2.5902×10^{-3}	1.1189×10^{2}
lb_M hr^{-1} in.$^{-1}$	4.9605	4.9605×10^{-2}	5.0582×10^{-5}	7.1947×10^{-7}	1.0361×10^{-4}	1.9985×10^{-10}	2.8779×10^{-8}	4.9605×10^{-2}	2.7778×10^{-4}	1.2000×10^{1}	8.6337×10^{-6}	3.7297×10^{-1}
lb_M hr^{-1} ft^{-1}	4.1338×10^{-1}	4.1338×10^{-3}	4.2152×10^{-6}	5.9957×10^{-8}	8.6339×10^{-6}	1.6655×10^{-11}	2.3985×10^{-9}	4.1336×10^{-3}	2.3148×10^{-5}	1	7.1946×10^{-7}	3.1081×10^{-2}

[b]Conversion factors for viscosity are based on a tabulation by Hawkins, Solberg, and Sibbitt in ref. 42.

TABLE 13.- TEMPERATURE INTERCONVERSION TABLE[a]

°K	°C	°F	°R
0	-273.16	-459.69	0
3.16	-270	-454.00	5.69
5.38	-267.78	-450	9.69
5.56	-267.60	-449.69	10
10	-263.16	-441.69	18.00
10.94	-262.22	-440	19.69
11.11	-262.05	-439.69	20
13.16	-260	-436.00	23.69
16.49	-256.67	-430	29.69
16.67	-256.49	-429.69	30
20	-253.16	-423.69	36.00
22.05	-251.11	-420	39.69
22.22	-250.94	-419.69	40
23.16	-250	-418.00	41.69
27.60	-245.56	-410	49.69
27.78	-245.38	-409.69	50
30	-243.16	-405.69	54.00
33.16	-240	-400	59.69
33.33	-239.83	-399.69	60
38.72	-234.44	-390	69.69
38.89	-234.27	-389.69	70
40	-233.16	-387.69	72.00
43.16	-230	-382.00	77.69
44.27	-228.89	-380	79.69
44.44	-228.72	-379.69	80
49.83	-223.33	-370	89.69
50	-223.16	-369.69	90
53.16	-220	-364.00	95.69
55.38	-217.78	-360	99.69
55.56	-217.60	-359.69	100
60	-213.16	-351.69	108.00
60.94	-212.22	-350	109.69
61.11	-212.05	-349.69	110
63.16	-210	-346.00	113.69
66.49	-206.67	-340	119.69
66.67	-206.49	-339.69	120
70	-203.16	-333.69	126.00
72.05	-201.11	-330	129.69
72.22	-200.94	-329.69	130
73.16	-200	-328.00	131.69
77.60	-195.56	-320	139.69
77.78	-195.38	-319.69	140
80	-193.16	-315.69	144.00
83.16	-190	-310	149.69
83.33	-189.83	-309.69	150
88.72	-184.44	-300	159.69
88.89	-184.27	-299.69	160
90	-183.16	-297.69	162.00
93.16	-180	-292.00	167.69
94.27	-178.89	-290	169.69
94.44	-178.72	-289.69	170
99.83	-173.33	-280	179.69
100	-173.16	-279.69	180

°K	°C	°F	°R
100	-173.16	-279.69	180
103.16	-170	-274.00	185.69
105.38	-167.78	-270	189.69
105.56	-167.60	-269.69	190
110	-163.16	-261.69	198.00
110.94	-162.22	-260	199.69
111.11	-162.05	-259.69	200
113.16	-160	-256.00	203.69
116.49	-156.67	-250	209.69
116.67	-156.49	-249.69	210
120	-153.16	-243.69	216.00
122.05	-151.11	-240	219.69
122.22	-150.94	-239.69	220
123.16	-150	-238.00	221.69
127.60	-145.56	-230	229.69
127.78	-145.38	-229.69	230
130	-143.16	-225.69	234.00
133.16	-140	-220	239.69
133.33	-139.83	-219.69	240
138.72	-134.44	-210	249.69
138.89	-134.27	-209.69	250
140	-133.16	-207.69	252.00
143.16	-130	-202.00	257.69
144.27	-128.89	-200	259.69
144.44	-128.72	-199.69	260
149.83	-123.33	-190	269.69
150	-123.16	-189.69	270
153.16	-120	-184.00	275.69
155.38	-117.78	-180	279.69
155.56	-117.60	-179.69	280
160	-113.16	-171.69	288.00
160.94	-112.22	-170	289.69
161.11	-112.05	-169.69	290
163.16	-110	-166.00	293.69
166.49	-106.67	-160	299.69
166.67	-106.49	-159.69	300
170	-103.16	-153.69	306.00
172.05	-101.11	-150	309.69
172.22	-100.94	-149.69	310
173.16	-100	-148.00	311.69
177.60	-95.56	-140	319.69
177.78	-95.38	-139.69	320
180	-93.16	-135.69	324.00
183.16	-90	-130	329.69
183.33	-89.83	-129.69	330
188.72	-84.44	-120	339.69
188.89	-84.27	-119.69	340
190	-83.16	-117.69	342.00
193.16	-80	-112.00	347.69
194.27	-78.89	-110	349.69
194.44	-78.72	-109.69	350
199.83	-73.33	-100	359.69
200	-73.16	-99.69	360

°K	°C	°F	°R
200	-73.16	-99.69	360
203.16	-70	-94.00	365.69
205.38	-67.78	-90	369.69
205.56	-67.60	-89.69	370
210	-63.16	-81.69	378.00
210.94	-62.22	-80	379.69
211.11	-62.05	-79.69	380
213.16	-60	-76.00	383.69
216.49	-56.67	-70	389.69
216.67	-56.49	-69.69	390
220	-53.16	-63.69	396.00
222.05	-51.11	-60	399.69
222.22	-50.94	-59.69	400
223.16	-50	-58.00	401.69
227.60	-45.56	-50	409.69
227.78	-45.38	-49.69	410
230	-43.16	-45.69	414.00
233.16	-40	-40	419.69
233.33	-39.83	-39.69	420
238.72	-34.44	-30	429.69
238.89	-34.27	-29.69	430
240	-33.16	-27.69	432.00
243.16	-30	-22.00	437.69
244.27	-28.89	-20	439.69
244.44	-28.72	-19.69	440
249.83	-23.33	-10	449.69
250	-23.16	-9.69	450
253.16	-20	-4.00	455.69
255.38	-17.78	0	459.69
255.56	-17.60	+.31	460
260	-13.16	+8.31	468.00
260.94	-12.22	10	469.69
261.11	-12.05	10.31	470
263.16	-10	14.00	473.69
266.49	-6.67	20	479.69
266.67	-6.49	20.31	480
270	-3.16	26.31	486.00
272.05	-1.11	30	489.69
272.22	-.94	30.31	490
273.16	0	32.00	491.69
277.60	4.44	40	499.69
277.78	4.62	40.31	500
280	6.84	44.31	504.00
283.16	10	50	509.69
283.33	10.17	50.31	510
288.72	15.56	60	519.69
288.89	15.73	60.31	520
290	16.84	62.31	522.00
293.16	20	68.00	527.69
294.27	21.11	70	529.69
294.44	21.28	70.31	530
299.83	26.67	80	539.69
300	26.84	80.31	540

°K	°C	°F	°R
300	26.84	80.31	540
303.16	30	86.00	545.69
305.38	32.22	90	549.69
305.56	32.40	90.31	550
310	36.84	98.31	558.00
310.94	37.78	100	559.69
311.11	37.95	100.31	560
313.16	40	104.00	563.69
316.49	43.33	110	569.69
316.67	43.51	110.31	570
320	46.84	116.31	576.00
322.05	48.89	120	579.69
322.22	49.06	120.31	580
323.16	50	122.00	581.69
327.60	54.44	130	589.69
327.78	54.62	130.31	590
330	56.84	134.31	594.00
333.16	60	140	599.69
333.33	60.17	140.31	600
338.72	65.56	150	609.69
338.89	65.73	150.31	610
340	66.84	152.31	612.00
343.16	70	158.00	617.69
344.27	71.11	160	619.69
344.44	71.28	160.31	620
349.83	76.67	170	629.69
350	76.84	170.31	630
353.16	80	176.00	635.69
355.38	82.22	180	639.69
355.56	82.40	180.31	640
360	86.84	188.31	648.00
360.94	87.78	190	649.69
361.11	87.95	190.31	650
363.16	90	194.00	653.69
366.49	93.33	200	659.69
366.67	93.51	200.31	660
370	96.84	206.31	666.00
372.05	98.89	210	669.69
372.22	99.06	210.31	670
373.16	100	212.00	671.69
377.60	104.44	220	679.69
377.78	104.62	220.31	680
380	106.84	224.31	684.00
383.16	110	230	689.69
383.33	110.17	230.31	690
388.72	115.56	240	699.69
388.89	115.73	240.31	700
390	116.84	242.31	702.00
393.16	120	248.00	707.69
394.27	121.11	250	709.69
394.44	121.28	250.31	710
399.83	126.67	260	719.69
400	126.84	260.31	720

°K	°C	°F	°R
400	126.84	260.31	720
403.16	130	266.00	725.69
405.38	132.22	270	729.69
405.56	132.40	270.31	730
410	136.84	278.31	738.00
410.94	137.78	280	739.69
411.11	137.95	280.31	740
413.16	140	284.00	743.69
416.49	143.33	290	749.69
416.67	143.51	290.31	750
420	146.84	296.31	756.00
422.05	148.89	300	759.69
422.22	149.06	300.31	760
423.16	150	302.00	761.69
427.60	154.44	310	769.69
427.78	154.62	310.31	770
430	156.84	314.31	774.00
433.16	160	320	779.69
433.33	160.17	320.31	780
438.72	165.56	330	789.69
438.89	165.73	330.31	790
440	166.84	332.31	792.00
443.16	170	338.00	797.69
444.27	171.11	340	799.69
444.44	171.28	340.31	800
449.83	176.67	350	809.69
450	176.84	350.31	810
453.16	180	356.00	815.69
455.38	182.22	360	819.69
455.56	182.40	360.31	820
460	186.84	368.31	828.00
460.94	187.78	370	829.69
461.11	187.95	370.31	830
463.16	190	374.00	833.69
466.49	193.33	380	839.69
466.67	193.51	380.31	840
470	196.84	386.31	846.00
472.05	198.89	390	849.69
472.22	199.06	390.31	850
473.16	200	392.00	851.69
477.60	204.44	400	859.69
477.78	204.62	400.31	860
480	206.84	404.31	864.00
483.16	210	410	869.69
483.33	210.17	410.31	870
488.72	215.56	420	879.69
488.89	215.73	420.31	880
490	216.84	422.31	882.00
493.16	220	428.00	887.69
494.27	221.11	430	889.69
494.44	221.28	430.31	890
499.83	226.67	440	899.69
500	226.84	440.31	900

°K / °C	°R / °F
1	1.8
2	3.6
3	5.4
4	7.2
5	9.0
6	10.8
7	12.6
8	14.4
9	16.2
10	18.0

°R / °F	°K / °C
1	0.56
2	1.11
3	1.67
4	2.22
5	2.78
6	3.33
7	3.89
8	4.44
9	5.00
10	5.56
11	6.11
12	6.67
13	7.22
14	7.78
15	8.33
16	8.89
17	9.44
18	10.00

[a]Prepared by the Thermal Tables Project, Thermodynamics Section, National Bureau of Standards, and reprinted from reference 43.

TABLE 13.- TEMPERATURE INTERCONVERSION TABLE[a] - Concluded

°K	°C	°F	°R
500	226.84	440.31	900
503.16	230	446.00	905.69
505.38	232.22	450	909.69
505.56	232.40	450.31	910
510	236.84	458.31	918.00
510.94	237.78	460	919.69
511.11	237.95	460.31	920
513.16	240	464.00	923.69
516.49	243.33	470	929.69
516.67	243.51	470.31	930
520	246.84	476.31	936.00
522.05	248.89	480	939.69
522.22	249.06	480.31	940
523.16	250	482.00	941.69
527.60	254.44	490	949.69
527.78	254.62	490.31	950
530	256.84	494.31	954.00
533.16	260	500	959.69
533.33	260.17	500.31	960
538.72	265.56	510	969.69
538.89	265.73	510.31	970
540	266.84	512.31	972.00
543.16	270	518.00	977.69
544.27	271.11	520	979.69
544.44	271.28	520.31	980
549.83	276.67	530	989.69
550	276.84	530.31	990
553.16	280	536.00	995.69
555.38	282.22	540	999.69
555.56	282.40	540.31	1000
560	286.84	548.31	1008.00
560.94	287.78	550	1009.69
561.11	287.95	550.31	1010
563.16	290	554.00	1013.69
566.49	293.33	560	1019.69
566.67	293.51	560.31	1020
570	296.84	566.31	1026.00
572.05	298.89	570	1029.69
572.22	299.06	570.31	1030
573.16	300	572.00	1031.69
577.60	304.44	580	1039.69
577.78	304.62	580.31	1040
580	306.84	584.31	1044.00
583.16	310	590	1049.69
583.33	310.17	590.31	1050
588.72	315.56	600	1059.69
588.89	315.73	600.31	1060
590	316.84	602.31	1062.00
593.16	320	608.00	1067.69
594.27	321.11	610	1069.69
594.44	321.28	610.31	1070
599.83	326.67	620	1079.69
600	326.84	620.31	1080

°K	°C	°F	°R
600	326.84	620.31	1080
603.16	330	626.00	1085.69
605.38	332.22	630	1089.69
605.56	332.40	630.31	1090
610	336.84	638.31	1098.00
610.94	337.78	640	1099.69
611.11	337.95	640.31	1100
613.16	340	644.00	1103.69
616.49	343.33	650	1109.69
616.67	343.51	650.31	1110
620	346.84	656.31	1116.00
622.05	348.89	660	1119.69
622.22	349.06	660.31	1120
623.16	350	662.00	1121.69
627.60	354.44	670	1129.69
627.78	354.62	670.31	1130
630	356.84	674.31	1134.00
633.16	360	680	1139.69
633.33	360.17	680.31	1140
638.72	365.56	690	1149.69
638.89	365.73	690.31	1150
640	366.84	692.31	1152.00
643.16	370	698.00	1157.69
644.27	371.11	700	1159.69
644.44	371.28	700.31	1160
649.83	376.67	710	1169.69
650	376.84	710.31	1170
653.16	380	716.00	1175.69
655.38	382.22	720	1179.69
655.56	382.40	720.31	1180
660	386.84	728.31	1188.00
660.94	387.78	730	1189.69
661.11	387.95	730.31	1190
663.16	390	734.00	1193.69
666.49	393.33	740	1199.69
666.67	393.51	740.31	1200
670	396.84	746.31	1206.00
672.05	398.89	750	1209.69
672.22	399.06	750.31	1210
673.16	400	752.00	1211.69
677.60	404.44	760	1219.69
677.78	404.62	760.31	1220
680	406.84	764.31	1224.00
683.16	410	770	1229.69
683.33	410.17	770.31	1230
688.72	415.56	780	1239.69
688.89	415.73	780.31	1240
690	416.84	782.31	1242.00
693.16	420	788.00	1247.69
694.27	421.11	790	1249.69
694.44	421.28	790.31	1250
699.83	426.67	800	1259.69
700	426.84	800.31	1260

°K	°C	°F	°R
700	426.84	800.31	1260
703.16	430	806.00	1265.69
705.38	432.22	810	1269.69
705.56	432.40	810.31	1270
710	436.84	818.31	1278.00
710.94	437.78	820	1279.69
711.11	437.95	820.31	1280
713.16	440	824.00	1283.69
716.49	443.33	830	1289.69
716.67	443.51	830.31	1290
720	446.84	836.31	1296.00
722.05	448.89	840	1299.69
722.22	449.06	840.31	1300
723.16	450	842.00	1301.69
727.60	454.44	850	1309.69
727.78	454.62	850.31	1310
730	456.84	854.31	1314.00
733.16	460	860	1319.69
733.33	460.17	860.31	1320
738.72	465.56	870	1329.69
738.89	465.73	870.31	1330
740	466.84	872.31	1332.00
743.16	470	878.00	1337.69
744.27	471.11	880	1339.69
744.44	471.28	880.31	1340
749.83	476.67	890	1349.69
750	476.84	890.31	1350
753.16	480	896.00	1355.69
755.38	482.22	900	1359.69
755.56	482.40	900.31	1360
760	486.84	908.31	1368.00
760.94	487.78	910	1369.69
761.11	487.95	910.31	1370
763.16	490	914.00	1373.69
766.49	493.33	920	1379.69
766.67	493.51	920.31	1380
770	496.84	926.31	1386.00
772.05	498.89	930	1389.69
772.22	499.06	930.31	1390
773.16	500	932.00	1391.69
777.60	504.44	940	1399.69
777.78	504.62	940.31	1400
780	506.84	944.31	1404.00
783.16	510	950	1409.69
783.33	510.17	950.31	1410
788.72	515.56	960	1419.69
788.89	515.73	960.31	1420
790	516.84	962.31	1422.00
793.16	520	968.00	1427.69
794.27	521.11	970	1429.69
794.44	521.28	970.31	1430
799.83	526.67	980	1439.69
800	526.84	980.31	1440

°K	°C	°F	°R
800	526.84	980.31	1440
803.16	530	986.00	1445.69
805.38	532.22	990	1449.69
805.56	532.40	990.31	1450
810	536.84	998.31	1458.00
810.94	537.78	1000	1459.69
811.11	537.95	1000.31	1460
813.16	540	1004.00	1463.69
816.49	543.33	1010	1469.69
816.67	543.51	1010.31	1470
820	546.84	1016.31	1476.00
822.05	548.89	1020	1479.69
822.22	549.06	1020.31	1480
823.16	550	1022.00	1481.69
827.60	554.44	1030	1489.69
827.78	554.62	1030.31	1490
830	556.84	1034.31	1494.00
833.16	560	1040	1499.69
833.33	560.17	1040.31	1500
838.72	565.56	1050	1509.69
838.89	565.73	1050.31	1510
840	566.84	1052.31	1512.00
843.16	570	1058.00	1517.69
844.27	571.11	1060	1519.69
844.44	571.28	1060.31	1520
849.83	576.67	1070	1529.69
850	576.84	1070.31	1530
853.16	580	1076.00	1535.69
855.38	582.22	1080	1539.69
855.56	582.40	1080.31	1540
860	586.84	1088.31	1548.00
860.94	587.78	1090	1549.69
861.11	587.95	1090.31	1550
863.16	590	1094.00	1553.69
866.49	593.33	1100	1559.69
866.67	593.51	1100.31	1560
870	596.84	1106.31	1566.00
872.05	598.89	1110	1569.69
872.22	599.06	1110.31	1570
873.16	600	1112.00	1571.69
877.60	604.44	1120	1579.69
877.78	604.62	1120.31	1580
880	606.84	1124.31	1584.00
883.16	610	1130	1589.69
883.33	610.17	1130.31	1590
888.72	615.56	1140	1599.69
888.89	615.73	1140.31	1600
890	616.84	1142.31	1602.00
893.16	620	1148.00	1607.69
894.27	621.11	1150	1609.69
894.44	621.28	1150.31	1610
899.83	626.67	1160	1619.69
900	626.84	1160.31	1620

°K	°C	°F	°R
900	626.84	1160.31	1620
903.16	630	1166.00	1625.69
905.38	632.22	1170	1629.69
905.56	632.40	1170.31	1630
910	636.84	1178.31	1638.00
910.94	637.78	1180	1639.69
911.11	637.95	1180.31	1640
913.16	640	1184.00	1643.69
916.49	643.33	1190	1649.69
916.67	643.51	1190.31	1650
920	646.84	1196.31	1656.00
922.05	648.89	1200	1659.69
922.22	649.06	1200.31	1660
923.16	650	1202.00	1661.69
927.60	654.44	1210	1669.69
927.78	654.62	1210.31	1670
930	656.84	1214.31	1674.00
933.16	660	1220	1679.69
933.33	660.17	1220.31	1680
938.72	665.56	1230	1689.69
938.89	665.73	1230.31	1690
940	666.84	1232.31	1692.00
943.16	670	1238.00	1697.69
944.27	671.11	1240	1699.69
944.44	671.28	1240.31	1700
949.83	676.67	1250	1709.69
950	676.84	1250.31	1710
953.16	680	1256.00	1715.69
955.38	682.22	1260	1719.69
955.56	682.40	1260.31	1720
960	686.84	1268.31	1728.00
960.94	687.78	1270	1729.69
961.11	687.95	1270.31	1730
963.16	690	1274.00	1733.69
966.49	693.33	1280	1739.69
966.67	693.51	1280.31	1740
970	696.84	1286.31	1746.00
972.05	698.89	1290	1749.69
972.22	699.06	1290.31	1750
973.16	700	1292.00	1751.69
977.60	704.44	1300	1759.69
977.78	704.62	1300.31	1760
980	706.84	1304.31	1764.00
983.16	710	1310	1769.69
983.33	710.17	1310.31	1770
988.72	715.56	1320	1779.69
988.89	715.73	1320.31	1780
990	716.84	1322.31	1782.00
993.16	720	1328.00	1787.69
994.27	721.11	1330	1789.69
994.44	721.28	1330.31	1790
999.83	726.67	1340	1799.69
1000	726.84	1340.31	1800

°K °C	°R °F
1	1.8
2	3.6
3	5.4
4	7.2
5	9.0
6	10.8
7	12.6
8	14.4
9	16.2
10	18.0

°R °F	°K °C
1	0.56
2	1.11
3	1.67
4	2.22
5	2.78
6	3.33
7	3.89
8	4.44
9	5.00
10	5.56
11	6.11
12	6.67
13	7.22
14	7.78
15	8.33
16	8.89
17	9.44
18	10.00

[a]Prepared by the Thermal Tables Project, Thermodynamics Section, National Bureau of Standards, and reprinted from reference 43.

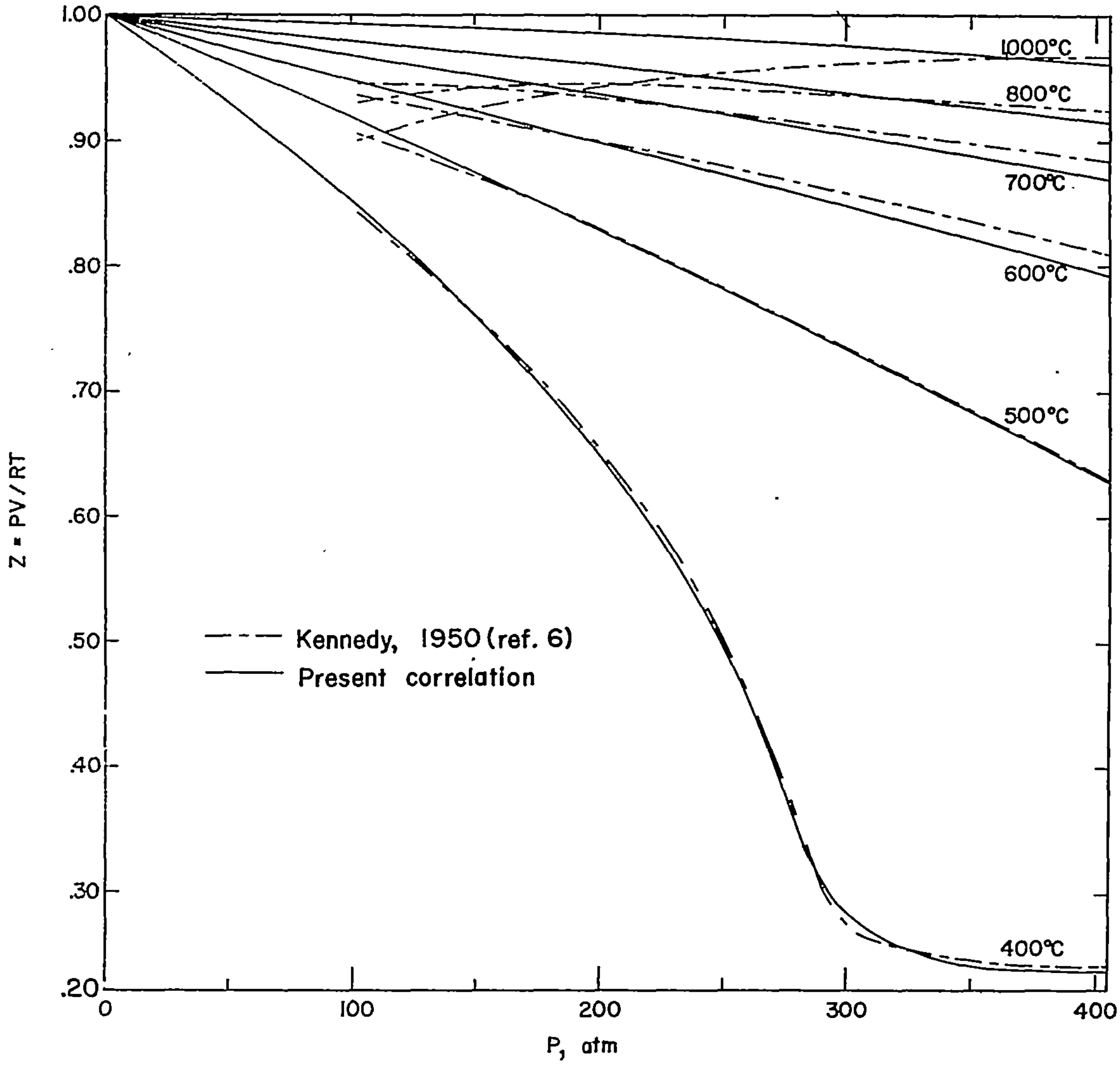


Figure 1.- Comparison of experimental data of Kennedy (ref. 6) with present correlation.

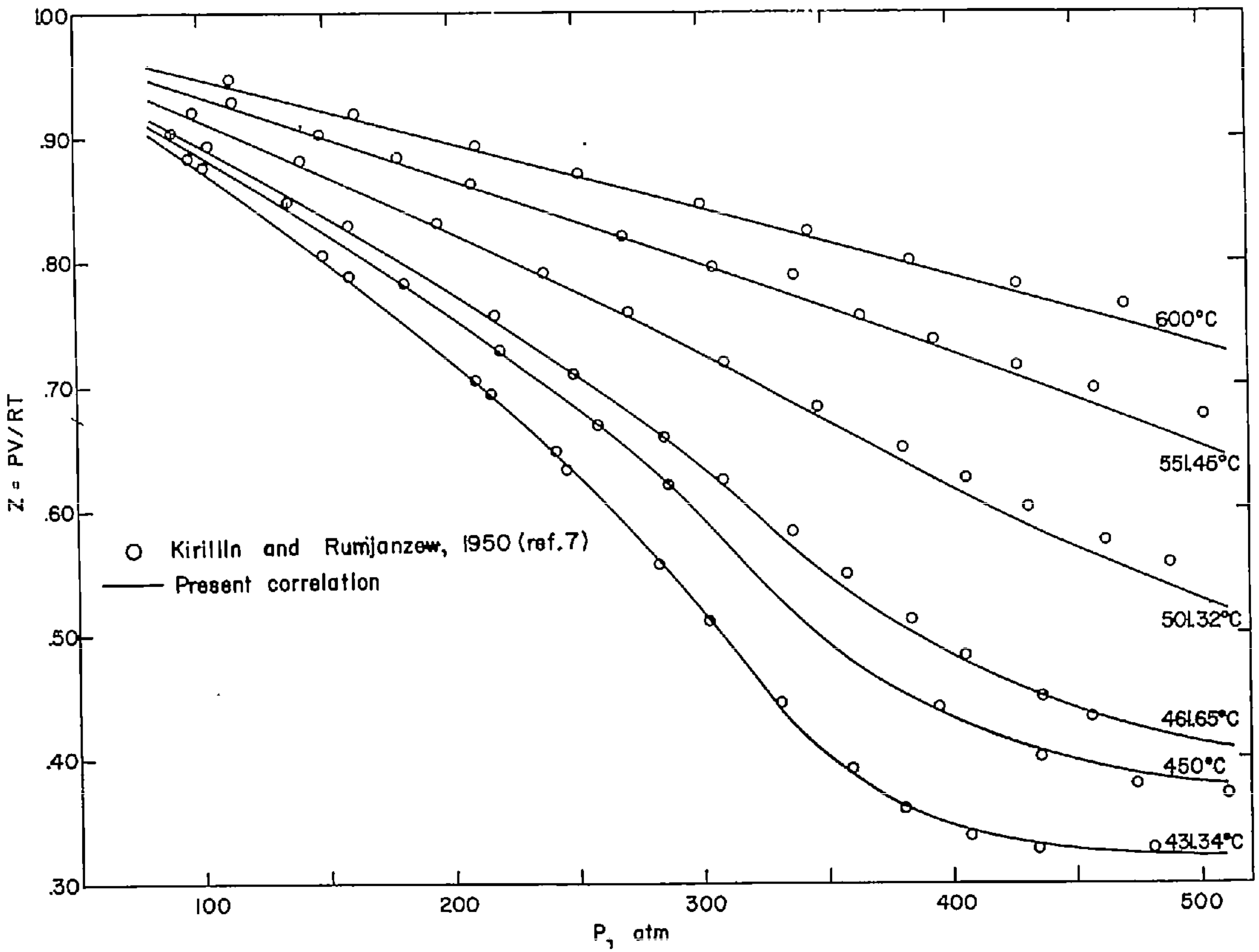


Figure 2.- Comparison of experimental data of Kirillin and Rumjanzev (ref. 7) with the present correlation.

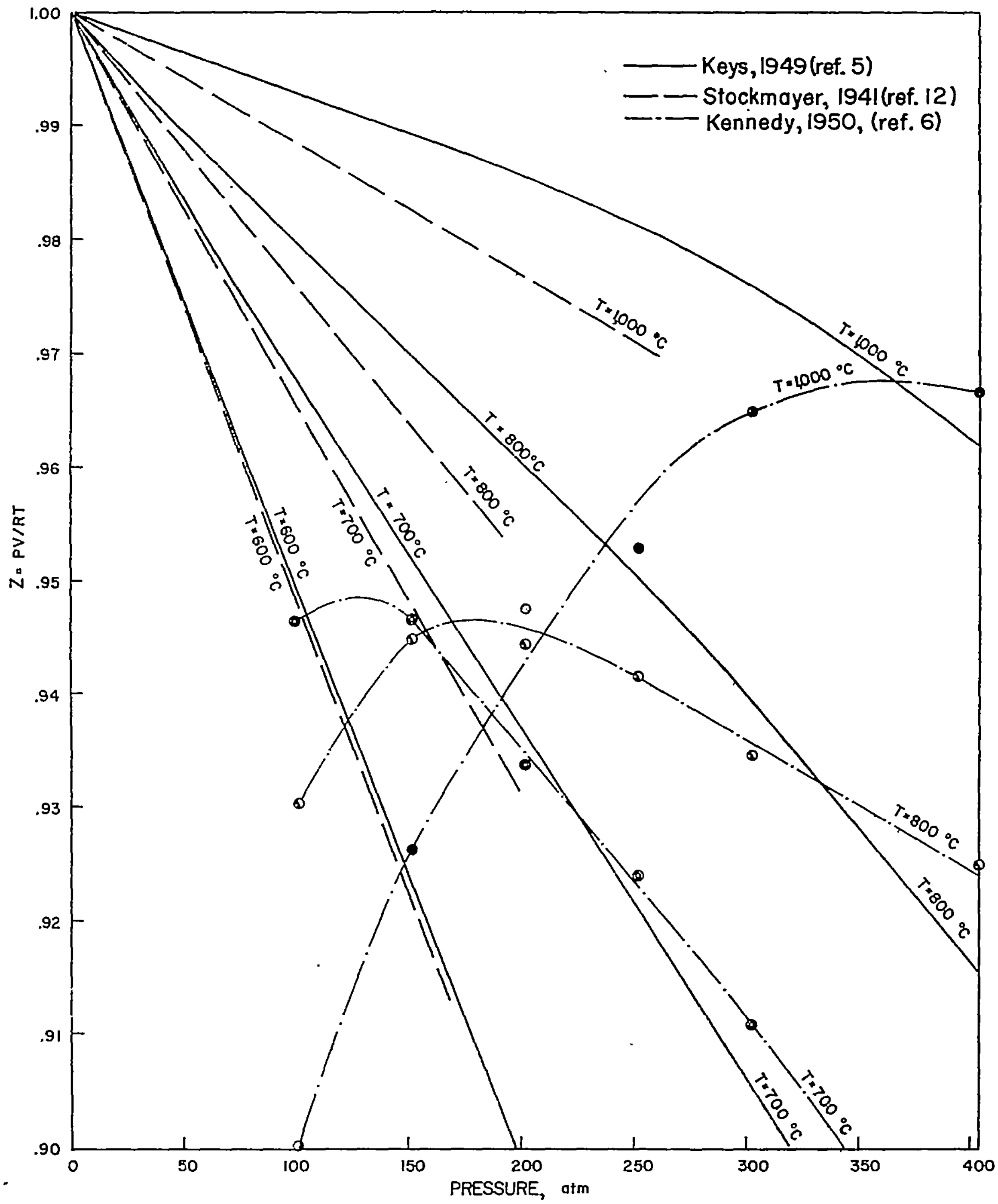
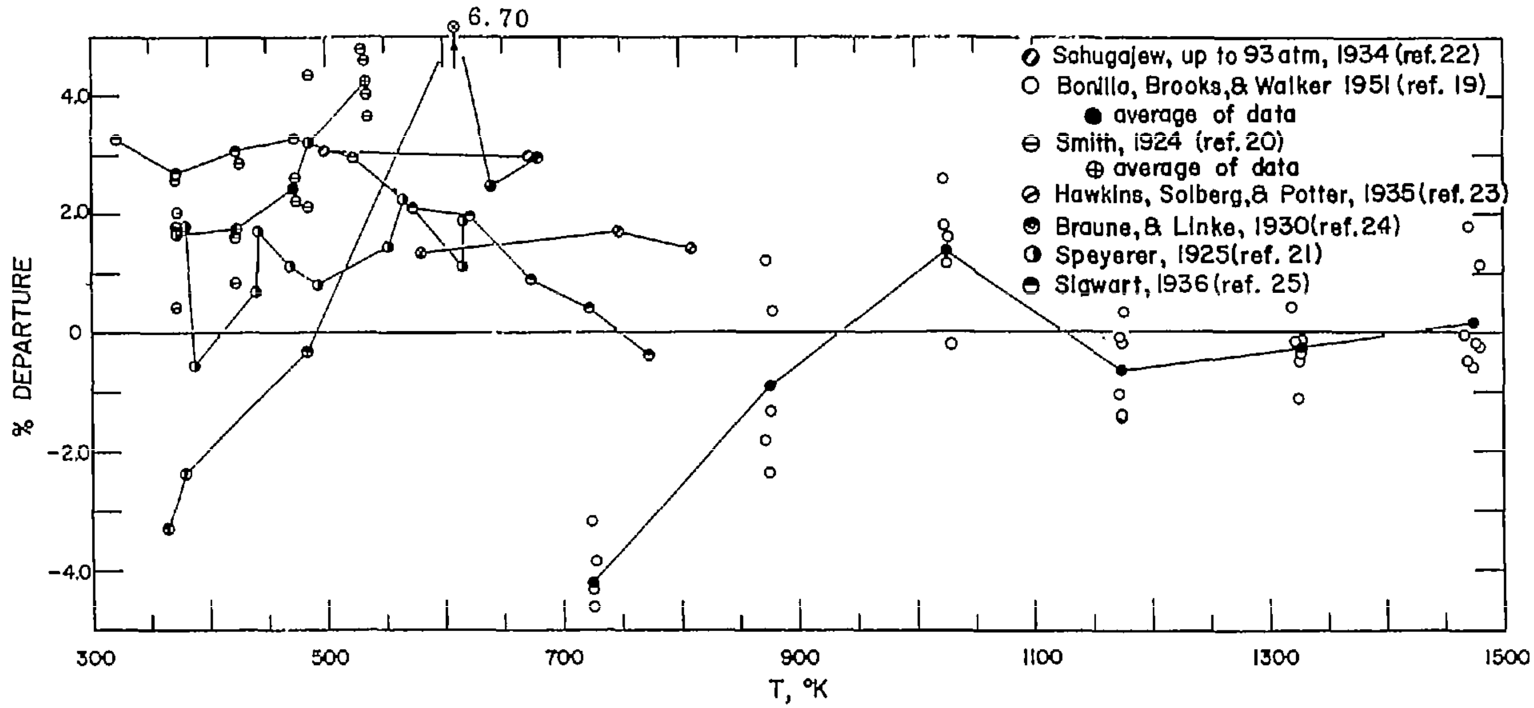
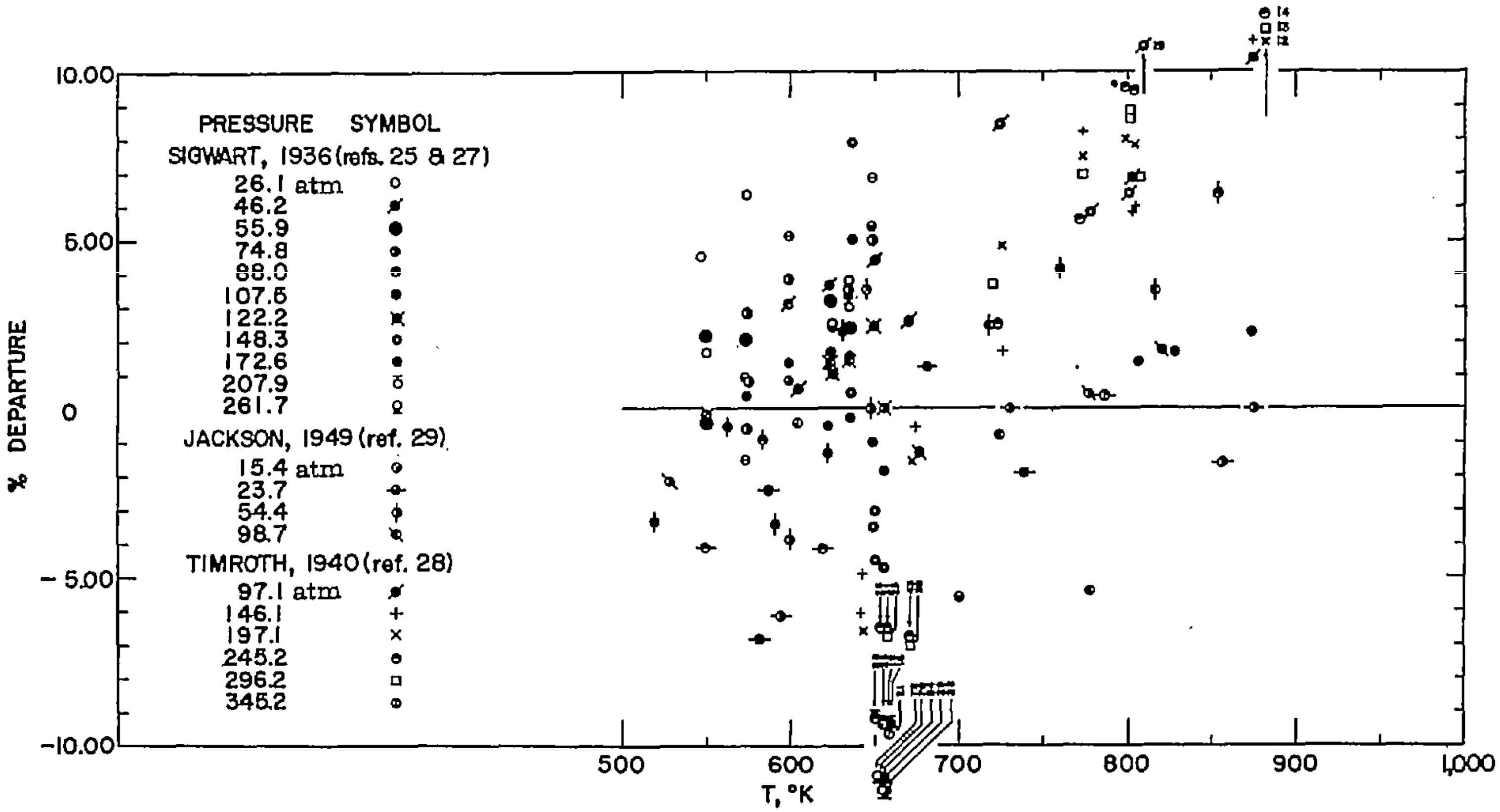


Figure 3.- Comparison of variously derived compressibility factors for steam.



(a) At P = 1 atmosphere (table 7(a)).

Figure 4.- Departure of experimental viscosities from tabulated values for steam (table 7). Percent departure, $\frac{\eta_{exp} - \eta_{calc}}{\eta_{calc}} \times 100$.



(b) At high pressures (table 7(b)).

Figure 4.- Concluded.

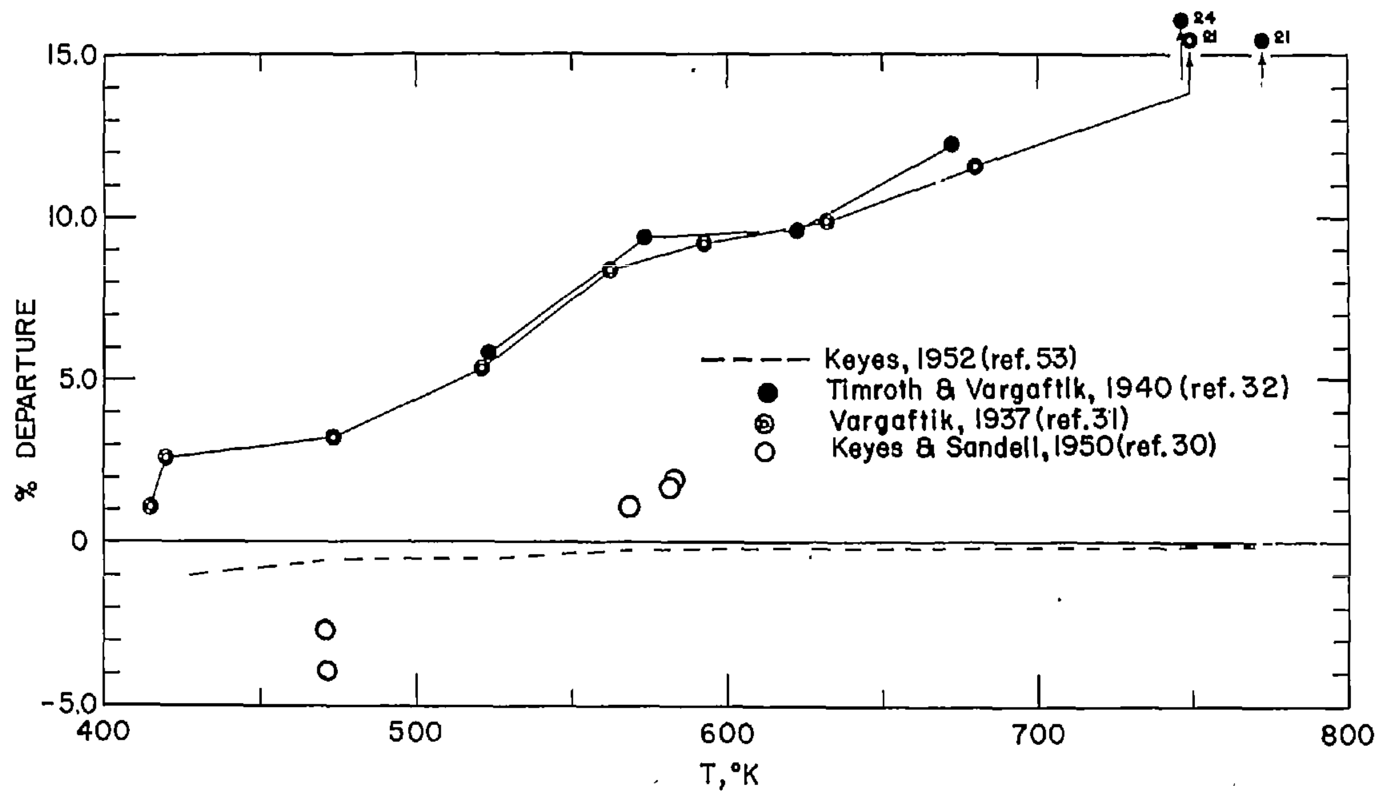


Figure 5.- Departures of low-pressure experimental thermal conductivities from tabulated values for steam (table 8). Percent departure, $\frac{k_{obs} - k_{tab}}{k_{tab}} \times 100$.

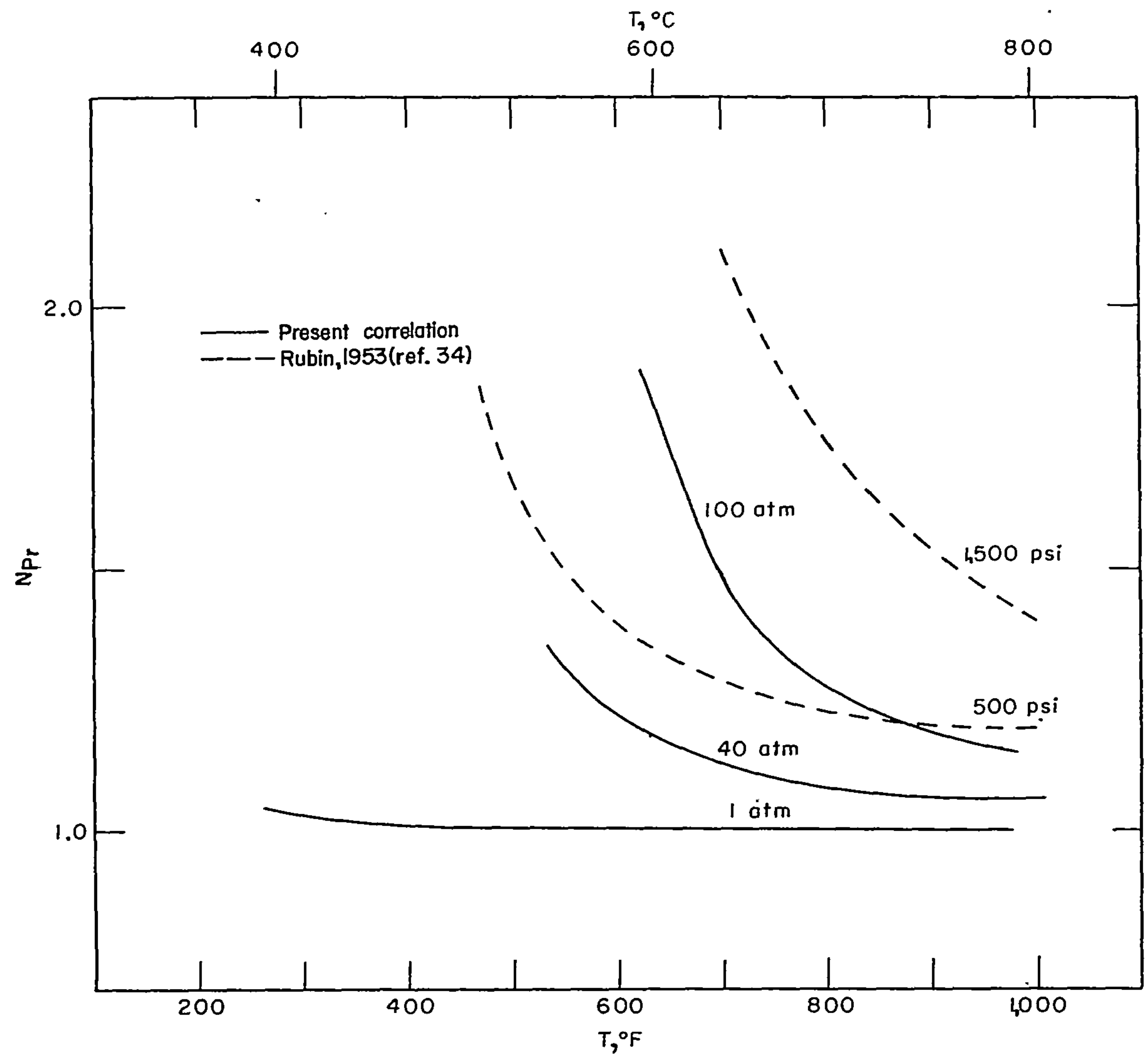


Figure 6.- Prandtl number for steam.

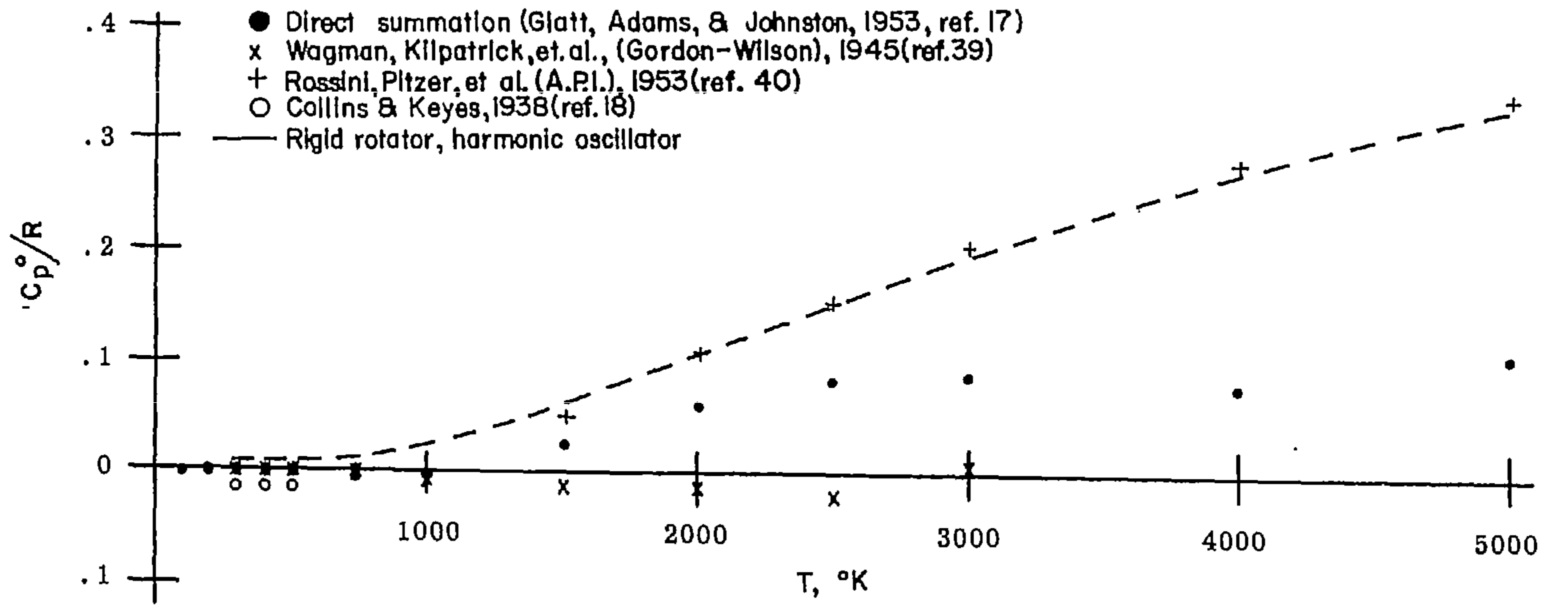


Figure 7.- Comparison of ideal-gas heat-capacity functions variously computed. Δ = Tabulated - Other.

M

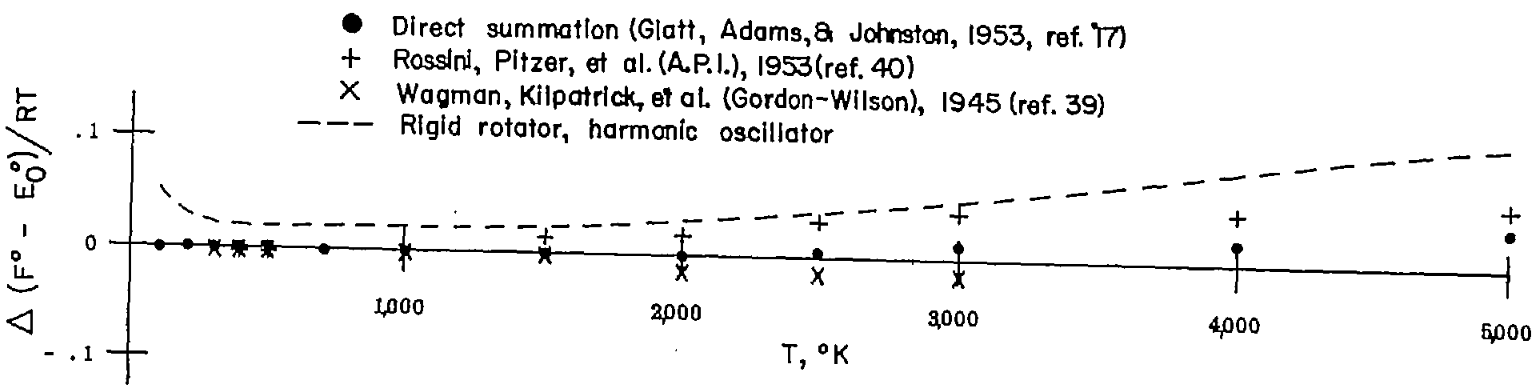


Figure 8.- Comparison of ideal-gas free-energy functions variously computed. Δ = Tabulated - Other.