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A MODIFIED BENEDICT-WEBB-RUBIN EQUATION OF STATE FOR PARAHYDROGEN

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A MODIFIED BENEDICT-WEBB-RUBIN EQUATION OF STATE FOR PARAHYDROGEN

Robert D. McCarty

A 32 term modified Benedict-Webb-Rubin equation of state has been applied to data for parahydrogen. The adjustable parameters in the equation of state were determined using data from the triple point to 2500 K, with pressures to 680 atmospheres. Extensive modifications have been made to the previously accepted PVT surface for the saturated liquid and vapor phases in the near critical region. These modifications have been made on the basis of subsequent refractive index data and the application of scaling law equations. Comparisons between experimental and calculated data are given.

Key words: Critical point; equation of state; hydrogen; index of refraction PVT; saturation properties; scaling laws

1. Introduction

For some applications of the equation of state for cryogenic fluids, it is advantageous to use a modified Benedict-Webb-Rubin equation of state (hereafter referred to as MBWR). One part of the work performed under NASA-LeRC Purchase Request C-32369-C was to provide a MBWR equation of state for hydrogen. Another part of the work to be performed here for NASA is an experimental program to supplement the existing data for parahydrogen (Roder, et al., 1965) with PVT data to higher pressures and temperatures. The equation of state work was to include these new experimental data in the estimation of the coefficients to a MBWR type of an equation of state. At the time of this writing, the experimental part of the total program is in progress and the funds for the continuation of the equation of state work do not seem to be available, at least in the near future. The purpose of this report is to collect and document the equation of state work performed to date. There are two reasons for reporting the equation of state work at this time. First, the work already accomplished is of sufficient importance that it should be made available to prospective users; and second, should the funds become available in the future to allow the continuation of the study, the earlier work will be preserved here.

2. Summary of Data Used

The PVT data of Goodwin, et al. (1963) and the specific heat capacity data of Younglove and Diller (1962) were used as the primary set of experimental data in the estimation of the coefficients to the equation of state. These data cover the pressure range of 0 to 340 atmospheres with temperatures from the triple point to 100 K. The NBS 1955 temperature scale was used to determine the temperatures of these data;

therefore, a conversion of the experimental temperatures to the International Practical Temperatures Scale of 1968 was made. In addition to the data set just mentioned, 173 PVT points from McCarty and Weber (1972) were used. These points were generated from equations which were used to extrapolate the PVT surface to higher pressures and higher temperatures. The equations used by McCarty and Weber are based on thermodynamic data selected from the literature and rely heavily on the data by Michels et al. (1963). Appendix A contains complete tables of deviations between the data used in the fit and the values predicted by the equation of state.

3. Saturated Liquid and Vapor PVT

Equations for the density of the saturated liquid and vapor were published by Roder, et al. (1963). These equations were based on the single phase experimental PVT data by Goodwin, et al. (1963) and the vapor pressure by Weber, et al. (1962). Since the data of Goodwin, et al. (1963) were converted to the 1968 International Practical Temperature Scale, these older equations for the saturation densities were no longer consistent with the experimental data, and it was decided to derive new equations for the saturation densities as well as the vapor pressures. After the saturation densities were published by Roder, et al. (1963), an index of refraction experiment by Diller (1968) indicated that the saturation densities in the very near critical region were in error by as much as 6%. This conclusion is based on the behavior of the saturation boundary shown on Diller's plot which is given here as fig. 1.

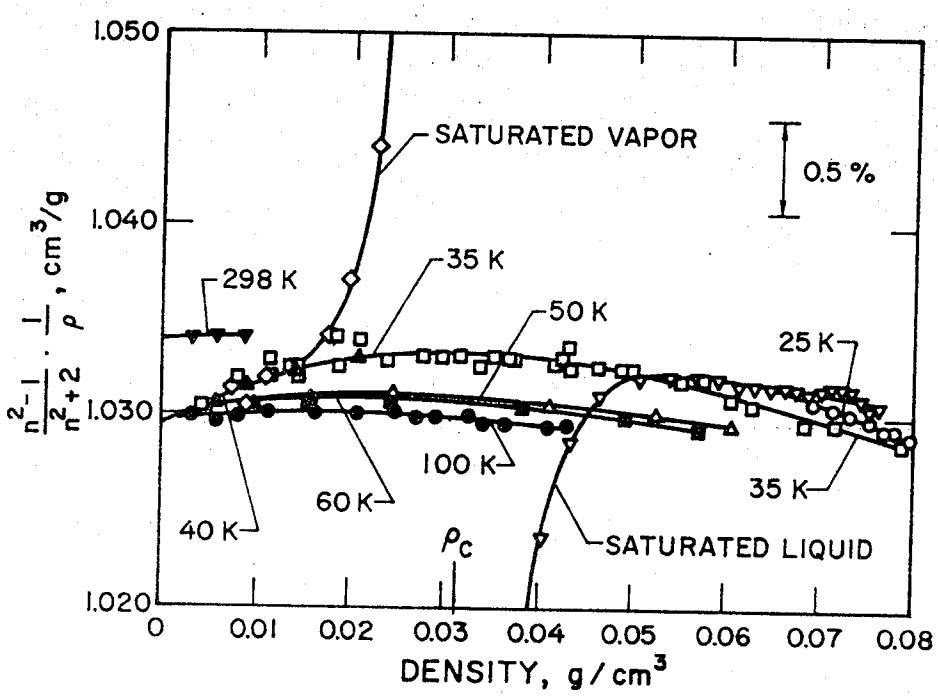

Figure 1. The Lorentz-Lorenz Function for Hydrogen

The Lorentz-Lorenz function of the saturation boundary, shown in fig. 1, should have the same general shape as do the isotherms.

The experiment involved measuring the index of refraction, the temperature and the pressure. The densities were then obtained from the data of Goodwin, et al. (1963). The reason for the two legs of the saturation curve not meeting in a smooth manner at the critical point is ascribed to incorrect densities in the critical region. To adjust the saturation densities in the critical region the function

$$\rho = \sum_{K=1}^{N} A_K \, n^{K-1}, \tag{1}$$

was fit to the 35 K isotherm, where ρ is density in g/cm^3 and n is the index of refraction. Equation (1) was fit to 24 points ranging in density from 0.003969 to .078833 g/cm^3. Statistical significance of the coefficients to eq (1) was lost when more than 4 terms were used and the 4 term equation was chosen, the coefficients to eq (1) are given in table 1.

Table 1. Lease Squares Estimates of the Coefficients for Equation (1)

A_1 = -1.0880215243 ± 0.214

A_2 = 1.8280271481 ± 0.604

A_3 = -1.0378774469 ± 0.567

A_4 = 0.29788205862 ± 0.177

The measured index of refraction along the saturation liquid and vapor lines were then used to calculate the corresponding densities according to eq (1). A comparison of densities reported by Roder, et al. (1963) and those calculated by eq (1) is given in table 2.

Table 2. Comparison of Densities Near the Critical Point

Temp, K			Density of Liquid, g/cm³			Density of Vapor, g/cm³	
NBS-55	IPTS 68	Index of Refraction	Roder et al. (1963)	Eq (1)	Index of Refraction	Roder et al. (1963)	Eq (1)
28.0	28.0071	1.092881	.058966	.058998	1.011312	.007298	.007299
29.0	29.0073	1.089174	.056646	.056674	1.013767	.008887	.008876
30.0	30.0076	1.084824	.053930	.053944	1.016892	.010882	.010881
31.0	31.0080	1.079479	.050589	.050586	1.021040	.013541	.013539
31.6	31.6082	1.075401	.048057	.048021			
32.0	32.0084	1.072075	.045993	.045927	1.027273	.017498	.017525
32.4	32.4086	1.067671	.043320	.043152	1.031177	.019934	.020017
32.7	32.7088	1.062766	.040412	.040057	1.035711	.022664	.022906
32.9	32.9089	1.055690	.036941	.035586	1.042271	.025490	.027074

To estimate the critical density and critical temperature, the equation

$$\rho = G_1 + G_2 |\Delta T|^{\beta} + \tag{2}$$

was fit to the corrected densities above 28 K. The liquid and vapor densities were fit separately, where $\Delta T = (T_c - T)/T_c$ and ρ and T are the density and temperature respectively. The parameters G_1, (G_1 corresponds to the critical density) G_2, T_c and β were estimated from the least squares fit of the data. Equation (2) is the first two terms of eq (6) and is only valid for densities very near the critical point. The truncation of eq (6) was used with the densities near the critical point to prevent any influence on the estimation of ρ_c and T_c by densities too far removed from the critical region. A critical density of 0.03254 g/cm^3 and a critical temperature of 32.433 K resulted from this fit. The ρ_c and T_c from the fit seemed reasonable, but the estimate of β was 0.407 which is higher than the 0.35 predicted by theory. The higher value of β suggests that some of the input densities may not be within the range of validity of eq (2).

The method of rectilinear diameters was tried next. A plot of $(\rho_\ell + \rho_g)/2$ against temperature, fig. 2, quickly shows that under the rectilinear diameter assumption, the critical density cannot possibly be much greater than 0.314 g/cm^3 and the 0.325 g/cm^3 estimated by eq (2) is not possible.

Forming an equation for the rectilinear diameter from eq (2) results in

$$(\rho_\ell + \rho)_g/2 = G_1 + \tfrac{1}{2}(G_{2\ell} + G_{2g})|\Delta T|^{\beta}, \tag{3}$$

however, $G_{2\ell}$ is usually assumed to be equal to $-G_{2g}$ and the second term of eq (3) vanishes. There is some doubt about the validity of this assumption, but in this particular case at least, the assumption cannot be disproved on the basis of the available data, and the problem of estimating β is eliminated. Taking the next two terms from eq (6) gives

$$\rho_g + \rho_\ell = 2\rho_c + (G_{3g} + G_{3\ell})|\Delta T|^{1-\alpha} + (G_{4g} + G_{4\ell})|\Delta T| \tag{4}$$

assuming $\alpha = 0.1$ and $T_c = 32.933$ K, a least squares fit of the eight pairs of liquid-vapor data in table 2 resulted in a critical density of 0.03136 g/cm^3. The fit was repeated several times with values of α and T_c ranging from $\alpha = 0.1$ to $\alpha = 0.25$ and $T_c = 32.938$ to $T_c = 32.95$. The resulting estimates of ρ_c did not vary significantly (i.e., maximum variation was less than $\pm.00001$ g/cm^3).

A refit of eq (2) fixing the critical density to the value found by the rectilinear diameter analysis gave results essentially the same as the first fit, i.e., a β of about 0.4 and T_c of 32.933 K. To achieve an interpolation formula for temperatures between 32.0 and 32.9 K, the function

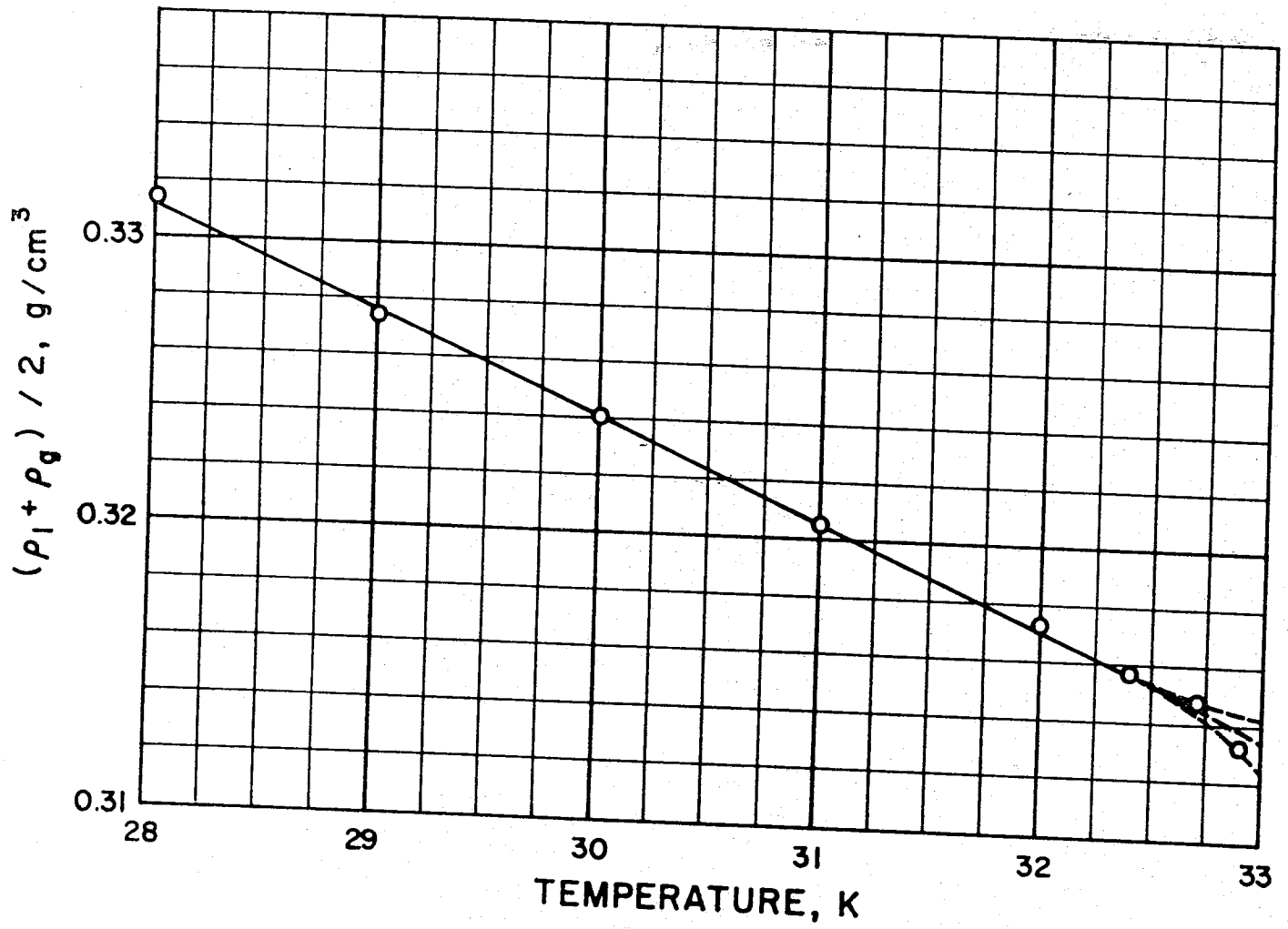

Figure 2. Rectilinear Diameters for Parahydrogen

$$n = r_c + r_1 (\Delta T)^{\beta'} , \tag{5}$$

where n is the index of refraction and $\Delta T = (T_c - T)/T_c$, was fit to the index of refraction data of the saturation boundary between 28 and 32.9 K. Table 3 gives the coefficients to eq (5). Combining eq (5) with eq (1) densities were calculated every 0.1 K between 31.9 and 32.8 K. These interpolated data were then used in a refit of eq (2) which resulted in $T_c = 32.938$, $\beta_{gas} = 0.3483$, and $\beta_{\ell q} = 0.3478$. Using these values for β and T_c the equation

$$\rho_{Sat} - \rho_c = G_1 (\Delta T)^{\beta} + \sum_{I=1}^{8} G_{(I+1)} (\Delta T)^{[1 + (I-1)/3]} , \tag{6}$$

was fit to the saturated liquid and vapor data of Roder, et al. (1963). The coefficients for eq (6) are given in table 4. Table 5 gives the deviations between calculated and input densities.

Table 3. Coefficients for Equation (5)

r_c	=	1.0509586594
T_c	=	32.93313976
r_1	=	0.091463402563
β'	=	0.41043983745

Table 4. Coefficients for Equation (6)

	Vapor	Liquid
ρ_c	0.03136 g/cm^3	0.03136 g/cm^3
β	0.3483	0.3479
G_1	-0.047501571529	0.048645813003
G_2	$3.4871213005 \times 10^{-2}$	$-3.4779278186 \times 10^{-2}$
G_3	$-4.1221290925 \times 10^{-1}$	$4.0776538192 \times 10^{-1}$
G_4	1.5666598550	-1.1719787304
G_5	-2.8061427339	1.62139244
G_6	2.7105455626	-1.1531096683
G_7	-1.3074773595	0.33825492039
G_8	0.22921285922	0.0

Table 5. Saturation Densities and Deviations from Equation (6)

Saturated Liquid				Saturated Vapor			
Temp, K T-68 Scale	Density, Eq(6) g/cm^3	Percent Diff.	Density, Exp. g/cm^3	Temp, K T-68 Scale	Density, Eq(6) g/cm^3	Percent Diff.	Density, Exp. g/cm^3
32.9089	.035571	0.04	.035586	32.8300	.024883	0.01	.024886
32.7088	.040071	-0.03	.040057	32.8400	.025100	0.01	.025102
32.4086	.043161	-0.02	.043152	32.8500	.025332	0.01	.025333
32.0084	.045911	0.04	.045927	32.8600	.025581	0.00	.025582
31.6082	.048023	-0.01	.048021	32.8700	.025852	0.00	.025852
31.0080	.050580	0.01	.050586	32.8800	.026150	-0.00	.026149
30.0076	.053945	-0.00	.053944	32.8900	.026483	-0.00	.026483
29.0073	.056664	0.02	.056674	32.9000	.026865	0.01	.026866
28.0071	.058980	0.03	.058998	32.9100	.027319	0.03	.027328
32.8300	.038028	-0.03	.038018	32.9000	.026865	0.01	.026866
32.8400	.037803	-0.02	.037796	32.7088	.022921	-0.06	.022906
32.8500	.037564	-0.01	.037559	32.4086	.020015	0.01	.020017
32.8600	.037307	-0.00	.037305	32.0084	.017522	0.02	.017525
32.8700	.037027	0.01	.037029	31.0080	.013537	0.02	.013539
32.8800	.036720	0.02	.036726	30.0076	.010883	-0.01	.010881
32.8900	.036377	0.03	.036387	29.0073	.008884	-0.09	.008876
32.9000	.035983	0.04	.035998	28.0071	.007297	0.02	.007299
32.9100	.035516	0.04	.035531	28.0071	.007297	0.02	.007299
13.8030	.077026	0.01	.077032	13.8030	.000126	-0.08	.000126
13.9977	.076861	-0.01	.076856	13.9977	.000139	0.05	.000139
15.0020	.075995	-0.01	.075987	15.0020	.000223	-0.05	.000223
16.0051	.075101	0.01	.075110	16.0051	.000339	-0.05	.000339
17.0071	.074171	-0.00	.074170	17.0071	.000492	0.00	.000492
18.0084	.073197	0.00	.073200	18.0084	.000690	0.06	.000690
19.0088	.072173	0.01	.072178	19.0088	.000938	0.11	.000939
20.0090	.071091	-0.01	.071084	20.0090	.001246	0.13	.001247
20.2770	.070791	-0.01	.070784	20.2770	.001339	-0.10	.001338
21.0089	.069944	0.01	.069949	21.0089	.001620	-0.10	.001619
22.0088	.068721	-0.02	.068710	22.0088	.002072	-0.05	.002071
23.0086	.067414	0.01	.067423	23.0086	.002612	-0.01	.002612
24.0083	.066009	0.00	.066010	24.0083	.003254	0.01	.003255
25.0078	.064490	-0.00	.064489	25.0078	.004016	0.01	.004017
26.0073	.062835	0.01	.062841	26.0073	.004921	0.01	.004921
27.0071	.061014	0.00	.061015	27.0071	.005999	0.01	.006000
28.0071	.058980	-0.03	.058963	28.0071	.007297	0.01	.007298
29.0073	.056664	-0.04	.056643	29.0073	.008884	0.03	.008887

The vapor pressure data of Weber, et al. (1962) was converted to the 1968 International Practical Temperature Scale and fit to the vapor pressure equation of Goodwin (1969). That equation is

$$\ell n\,(P/P_t) = B_1 X + B_2 X^2 + B_3 X^3 + B_4 X\,(1-X)^{B_5}\ , \qquad (7)$$

where $X = (1-T_t/T)/(1-T_t/T_c)$, T is in kelvins. The coefficients to eq (7) are given in table 6. The two data points given by Weber, et al. (1962) for T = 22 and 23 K were left out of the fit because their inclusion degraded the representation of the rest of the data. The IPTS-68 triple point temperature of hydrogen of 13.81 K was not used because it also degraded the fit. Table 7 gives the vapor pressures from Weber, et al. (1962) and the deviations between the experimental and calculated data points.

Table 6. Coefficients for Equation (7)

T_t	=	13.8 K
T_c	=	32.938 K
P_t	=	0.0695 atm
B_1	=	3.05300134164
B_2	=	2.80810925813
B_3	=	-0.655461216567
B_4	=	1.59514439374
B_5	=	1.5814454428

4. The Equation of State for Hydrogen

Since the first major modification of the Benedict-Webb-Rubin equation of state by Strobridge (1962), there have been many more. Each author claims his particular modification to be the best of several he has tried for the particular fluid being correlated. In some cases the particular form was chosen because it worked well for a number of fluids.

Two of these MBWR's have been used with good success for several different fluids. The first is a 19 term version by Bender (1970) and the other is a 32 term version by Jacobsen (1972). The data set mentioned in section 2 was fit to both of these equations and not too surprisingly the 32 term equation worked the best, and consequently is used here. In addition to the data summarized in section 2, PVT values for the saturated liquid and vapor phases were generated from the equations in section 3 and included in the fit. The equation of state is

Table 7. Vapor Pressures and Deviations

Pressure, atm Experimental	Temp, K	Pressure, atm Eq (7)	Percent Diff.
1.6124	22.0088	1.6143	-0.12*
2.0688	23.0086	2.0712	-0.11*
1.0000	20.2770	1.0000	-0.00
3.2462	25.0078	3.2469	-0.02
3.9826	26.0073	3.9822	0.01
4.8285	27.0071	4.8275	0.02
5.7920	28.0071	5.7918	0.00
6.8863	29.0073	6.8847	0.02
8.1162	30.0076	8.1169	-0.01
8.1169	30.0076	8.1169	-0.00
8.1171	30.0076	8.1169	0.00
8.7873	30.5078	8.7891	-0.02
8.7885	30.5078	8.7891	-0.01
8.7886	30.5078	8.7891	-0.01
9.5029	31.0080	9.5010	0.02
9.5023	31.0080	9.5010	0.01
9.5005	31.0080	9.5010	-0.01
9.5003	31.0080	9.5010	-0.01
10.2525	31.5082	10.2546	-0.02
10.2535	31.5082	10.2546	-0.01
10.2539	31.5082	10.2546	-0.01
11.0502	32.0084	11.0528	-0.02
11.0516	32.0084	11.0528	-0.01
11.0522	32.0084	11.0528	-0.01
11.8988	32.5087	11.8992	-0.00
11.8976	32.5087	11.8992	-0.01
11.8989	32.5087	11.8992	-0.00
12.0749	32.6087	12.0748	0.00
12.0742	32.6087	12.0748	-0.00
12.0751	32.6087	12.0748	0.00
12.2526	32.7088	12.2527	-0.00
12.2520	32.7088	12.2527	-0.01
12.2536	32.7088	12.2527	0.01
12.4326	32.8089	12.4330	-0.00
12.4330	32.8089	12.4330	0.00
12.4352	32.8089	12.4330	0.02
12.6168	32.9089	12.6160	0.01
12.6187	32.9089	12.6160	0.02
12.6183	32.9089	12.6160	0.02
0.0778	13.9977	0.0778	-0.03
0.1327	15.0020	0.1327	0.01
0.2129	16.0051	0.2129	0.01
0.3250	17.0071	0.3250	0.01
0.4759	18.0084	0.4759	-0.00
0.6726	19.0088	0.6727	-0.00
0.9228	20.0090	0.9229	-0.02
0.0695	13.8000	0.0695	-0.00
	32.9380	12.6698**	

* Points not included in the least squares fit.

** Critical pressure resulting from least squares fit, critical pressure and temperature given by Roder, et al. (1965) is 12.759 atm at 32.476 K.

$$
\begin{aligned}
P = \rho RT &+ \rho^2 (N_1 T + N_2 T^{1/2} + N_3 + N_4/T + N_5/T^2) \\
&+ \rho^3 (N_6 T + N_7 + N_8/T + N_9/T^2) \\
&+ \rho^4 (N_{10} T + N_{11} + N_{12}/T) + \rho_5 (N_{13}) \\
&+ \rho^6 (N_{14}/T + N_{15}/T^2) + \rho^7 (N_{16}/T) \\
&+ \rho^8 (N_{17}/T + N_{18}/T^2) + \rho^9 (N_{19}/T^2) \\
&+ \rho^3 (N_{20}/T^2 + N_{21}/T^3) \exp(-\gamma\rho^2) \\
&+ \rho^5 (N_{22}/T^2 + N_{23}/T^4) \exp(-\gamma\rho^2) \\
&+ \rho^7 (N_{24}/T^2 + N_{25}/T^3) \exp(-\gamma\rho^2) \\
&+ \rho^9 (N_{26}/T^2 + N_{27}/T^4) \exp(-\gamma\rho^2) \\
&+ \rho^{11} (N_{28}/T^2 + N_{29}/T^3) \exp(-\gamma\rho^2) \\
&+ \rho^{13} (N^{30}/T^2 + N_{31}/T^3 + N_{32}/T^4) \exp(-\gamma\rho^2)
\end{aligned}
\tag{8}
$$

where ρ is in moles per liter, P is in atmospheres, T is in kelvins, and R is 0.08205616 ℓ.atm/mol.K. The critical point was constrained to the value P = 12.670 atm, ρ = 15.556 moles per liter, T = 32.938 K and $\partial P/\partial\rho = \partial^2 P/\partial\rho^2 = 0$. The thermodynamic conditions for phase equilibrium for the coexisting liquid and vapor phases have been included as data in the least squares estimating procedure. The least squares estimates of the parameters (N_i) are given in table 8.

Table 8. Coefficients for Equation (8)

N_1	=	$9.7724756841 \times 10^{-4}$	N_{17}	=	$6.1714686495 \times 10^{-9}$
N_2	=	$2.7152251047 \times 10^{-2}$	N_{18}	=	$5.0101024725 \times 10^{-6}$
N_3	=	$-4.0181051493 \times 10^{-1}$	N_{19}	=	$-5.5717474190 \times 10^{-8}$
N_4	=	1.6841979481	N_{20}	=	$-1.8913610938 \times 10^{+2}$
N_5	=	$-2.1489533487 \times 10^{+1}$	N_{21}	=	$-3.7831399504 \times 10^{+2}$
N_6	=	$-1.6675599518 \times 10^{-6}$	N_{22}	=	$-8.4616109347 \times 10^{-1}$
N_7	=	$8.4131860302 \times 10^{-3}$	N_{23}	=	$1.3760409852 \times 10^{+1}$
N_8	=	$-5.7557476830 \times 10^{-1}$	N_{24}	=	$-1.1323039340 \times 10^{-3}$
N_9	=	$2.1149417739 \times 10^{+2}$	N_{25}	=	$1.3554583722 \times 10^{-3}$
N_{10}	=	$1.2387354960 \times 10^{-6}$	N_{26}	=	$-1.8443884951 \times 10^{-6}$
N_{11}	=	$-3.1280580947 \times 10^{-4}$	N_{27}	=	$-5.1666928590 \times 10^{-5}$
N_{12}	=	$2.5945419913 \times 10^{-2}$	N_{28}	=	$-2.9044621463 \times 10^{-10}$
N_{13}	=	$5.2494587855 \times 10^{-6}$	N_{29}	=	$5.0870054382 \times 10^{-9}$
N_{14}	=	$-9.5113449800 \times 10^{-7}$	N_{30}	=	$-1.0229323667 \times 10^{-12}$
N_{15}	=	$-7.2316698085 \times 10^{-3}$	N_{31}	=	$-2.0248578837 \times 10^{-12}$
N_{16}	=	$-3.8383727284 \times 10^{-7}$	N_{32}	=	$1.1900504363 \times 10^{-11}$

R = 0.8205616 ℓ.atm/mol.K

A complete listing of the computer program which was used to estimate the coefficients in table 8 is given in Appendix A. The listing includes a point by point comparison of the input experimental data with the corresponding values calculated using eq (8).

Conclusion

The equation of state, eq (8), is the best MBWR representation of the PVT surface of hydrogen which could be formulated at this time, as is always the case with the MBWR, the behavior at the critical point is analytic and, therefore, does not qualitatively or quantitatively represent the specific heat capacity at constant volume. When new experimental data for the high pressure region become available, the parameters for eq (8) should be re-estimated using the new data. The saturation boundary (liquid-vapor) as defined by eqs (6) and (7) need no further numerical treatment until new experimental data become available or the international practical temperature scale is re-defined. One of the objectives of this task was to develop an equation of state explicit in density. The curtailment of funding did not allow the pursuit of this objective to a degree of completion which could be reported here.

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Appendix A. Computer Listings

1)/14/73

```
      PROGRAM H2 FIT 1
      DIMENSION P(2000),D(2000),T(2000),PCV(300),TCV(300),DCV(300),
     1CV(300),A(33),G(32),F(40),Q(32)
      COMMON F,Y,NFUN
      COMMON/DATA/A,G,PP,DD,TT,GAMMA,ID
      COMMON/GIBS/RHOV,RHOL
      TYPE DOUBLE A,G,PP,DD,TT,GAMMA,F,Y,Q
      DATA(SIGP=.01),(SIGD=.001),(GAMMA=.001),(SIGT=.02)
      DATA(SIGCV=.04),(RE=8.31434),(R=.08205616)
      DO 10 I=1,2000
      READ 100,P(I),D(I),T(I)
      IF(P(I).LE.0.0)GO TO 11
   10 D(I)=D(I)*1000.
  100 FORMAT(4F15.1)
   11 NPVT=I-1
      DO 15 I=1,300
      READ 100,PCV(I),TCV(I),DCV(I),CV(I)
      IF(DCV(I).LE.0.0)GO TO 16
   15 DCV(I)=DCV(I)*1000.
   16 NCV=I-1
      NPVT=NPVT+1
      DO 800 I=NPVT,2000
      READ 801,P(I),D(I),T(I)
      IF(P(I).LT..001)GO TO 802
  800 CONTINUE
  801 FORMAT(3F10.1)
  802 NPVT=I-1
  806 FORMAT(11X,D30.20)
      GAMMA=-.0041
      NFUN=32
      NP=NFUN
      ICON=4
      CALL CPCON
      DO 20 I=1,NPVT
      DD=D(I)
      TT=T(I)
      PP=P(I)
      W=1./(PP*1000.)
      IF(DD.LT.20.)W=W*3.
      ID=0
      CALL PRESS
      DO 17 J=1,NP
   17 F(J)=A(J)*W
      Y=A(NP+1)*W
      CALL FIT
   20 CONTINUE
      IF(ICON.EQ.1)GO TO 41
      DO 30 I=1,NCV
      W=7./1000.
      DD=DCV(I)
      TT=TCV(I)
      ID=0
      CALL TDSDT
      DO 21 J=1,NP
   21 Q(J)=A(J)
```

```
      DD=0
      CALL TDSDT
      DO 22 J=1,NP
   22 F(J)=(A(J)-Q(J))*W
      Y=(CV(I)-CPO(TT,1)+RE)*W/101.325
      CALL FIT
   30 CONTINUE
      IF(ICON.EQ.2)GO TO 41
      DO 40 I=14,32
      TT=I
      IF(ICON.EQ.4)GO TO 33
      W=1.
      Y=-DPDTVP(TT)*(1./DSATV(TT)-1./DSATL(TT))*W
      DD=DSATV(TT)
      ID=0
      CALL DSDN
      DO 31 J=1,NP
   31 G(J)=A(J)
      DD=DSATL(TT)
      ID=0
      CALL DSDN
      DO 32 J=1,NP
   32 F(J)=(A(J)-G(J))*W
      CALL FIT
   33 W=1./10000.
      PP=VPN(TT)
      DD=DSATL(TT)
      NPVT=NPVT+1
      P(NPVT)=PP
      T(NPVT)=TT
      D(NPVT)=DD
      ID=0
      CALL PRESS
      DO 34 J=1,NP
   34 F(J)=A(J)*W
      Y=A(NP+1)*W
      CALL FIT
      CALL DUDN
      DO 36 J=1,NP
   36 Q(J)=A(J)
      DD=DSATV(TT)
      NPVT=NPVT+1
      P(NPVT)=PP
      T(NPVT)=TT
      D(NPVT)=DD
      W=1./(PP*1000.)
      W=W*3.
      IF(TT.GT.25.)W=W*5.
      ID=0
      CALL PRESS
      DO 35 J=1,NP
   35 F(J)=A(J)*W
      Y=A(NP+1)*W
      CALL FIT
      CALL DUDN
```

```
      DO 37 J=1,NP
   37 F(J)=(A(J)-Q(J))*W
      Y=P(NPVT)*(1./D(NPVT-1)-1./D(NPVT))+R*TT*(LOGF(D(NPVT-1)*R*TT)
     1-LOGF(D(NPVT)*R*TT))
      Y=Y*W
      CALL FIT
   40 CONTINUE
   41 CONTINUE
      CALL COEFF
      DO 43 I=1,NP
  805 FORMAT(*       G(*,I2,*)*,D30.20)
      Q(I)=G(I)
   43 G(I)=F(I)
  105 FORMAT(F10.4,3F10.3,2F10.2)
      DO 44 I=1,NP
   44 PUNCH 805,I,G(I)
      CALL STAT
      DO 50 I=1,NPVT
      IF(INDEX(I,50).GT.0)GO TO 42
      PRINT 101
      PRINT 102
   42 DD=D(I)
      TT=T(I)
      ID=1
      CALL PRESS
      PCAL=PP
      DQ=D(I)
      PQ=P(I)
      TQ=T(I)
      DCAL=FIND D(PQ,DQ,TQ)
      DDIF=(D(I)-DCAL)*100./D(I)
      PDIF=(P(I)-PCAL)*100./P(I)
   50 PRINT 103,P(I),D(I),T(I),PCAL,DCAL,PDIF,DDIF
      IF(ICON.EQ.1)GO TO 99
  103 FORMAT(2F10.3,2(F10.4,F10.3),2F10.2)
  101 FORMAT(1H1)
  102 FORMAT(*        PIN       D IN       T IN     P CAL     D CAL      P DIF
     1     D DIF*)
  104 FORMAT(*       D IN       T IN      CV IN      CV CAL     CV DIF*)
      DO 60 I=1,NCV
      IF(INDEX(I,50).GT.0)GO TO 51
      PRINT 101
      PRINT 104
   51 DD=DCV(I)
      TT=TCV(I)
      ID=1
      CALL TDSDT
      P1=PP
      DD=0
      CALL TDSDT
      P2=PP
      CVCAL=CPO(TT,1)-RE-(P1-P2)*101.325
      DIF=(CV(I)-CVCAL)*100./CV(I)
      DCAL=FIND D(PCV(I),DCV(I),TCV(I))
      DDIF=(DCV(I)-DCAL)*100./DCV(I)
```

```
 60 PRINT 105,DCV(I),TCV(I),CV(I),CVCAL,DIF,DDIF
    DO 70 I=14,32
    TT=I
    TG=TT
    VP=VPN(TG)
    DL=DSATL(TG)
    DV=DSATV(TG)
    DD=DL
    PP=VP
    ID=1
    CALL GIBBS
    P1=PP
    DD=DV
    PP=VP
    CALL GIBBS
    P2=PP
    P12=P1-P2
    PRINT 185,TT,P1,P2,P12,DV,DL
185 FORMAT(6E15.4)
 70 CONTINUE
 80 CONTINUE
 99 CONTINUE
    END
```

```
    SUBROUTINE CPCON
    DIMENSION G(32),A(33),F(40)
    COMMON/DATA/A,G,PP,DD,TT,GAMMA,ID
    COMMON F,Y,NFUN
    TYPE DOUBLE A,G,PP,DD,TT,GAMMA,F,Y
    TC=TT=32.938
    DC=DD=15.556
    PC=PP=12.67
    PRINT 100,PP,DD,TT
100 FORMAT(3F20.3)
    NP=32
    ID=0
    CALL PRESS
    DO 1 I=1,NP
  1 F(I)=A(I)
    Y=A(NP+1)
    CALL CONSTR
    PP=0
    CALL DPDD
    DO 2 I=1,NP
  2 F(I)=A(I)
    Y=A(NP+1)
    CALL CONSTR
    CALL DP2D2
    DO 3 I=1,NP
  3 F(I)=A(I)
    Y=0
    CALL CONSTR
    RETURN
    END
```

```
      SUBROUTINE FITTER
      DIMENSION F(40),A(40,41),B(40,41)
      COMMON F,Y,NFUN
      TYPE DOUBLE SY,SYY,RES,A,B
      TYPE DOUBLE F,Y
      COMMON /7777777/ A,SY,SYY,RES
      DATA (NDIM=40)
      DATA (NTR=-1)
      EQUIVALENCE (A,B),(CCC,RES),(DDD,SYY)
      EQUIVALENCE(NC,FNC)
      ENTRY FIT
      IF(NTR) 1,3,3
    1 NP=0
      NF=NFUN
      IF(NF.GT.NDIM) GO TO 44
      NC=0
      SY=0.
      SYY=0.
      NY=NF+1
      DO 2 I=1,NY
      DO 2 J=1,NF
    2 A(J,I)=0.
      IF(NTR.EQ.0) GO TO 11
      NTR=0
    3 SY=Y+SY
      SYY=SYY+Y*Y
      DO 4 J=1,NF
      A(J,NY)=A(J,NY)+Y*F(J)
      DO 4 I=1,NF
    4 A(I,J)=A(I,J)+F(I)*F(J)
      NP=NP+1
      RETURN
      ENTRY CONSTR
      IF(NTR) 10,11,11
   10 NTR=0
      GO TO 1
   11 N=NY-1
      IF(NY.GT.NDIM)GO TO 44
      DO 12 I=1,N
      A(I,NY+1)=A(I,NY)
   12 A(I,NY)=A(NY,I)=F(I)
      NC=NC+1
      DO 13 I=NF,N
   13 A(I+1,NY)=A(NY,I+1)=0.
      NY=NY+1
      A(NY-1,NY)=Y
      RETURN
      ENTRY COEFF
      N=NY-1
      DO 20 I=1,NF
   20 F(I)=A(I,NY)
      DO 22 I=2,N
      DO 21 J=I,NY
   21 A(I-1,J)=A(I-1,J)/A(I-1,I-1)
      DO 22 J=I,N
```

```
      DO 22 K=I,NY
   22 A(J,K)=A(J,K)-A(J,I-1)*A(I-1,K)
      A(N,NY)=A(N,NY)/A(N,N)
      DO 24 I=2,N
      L=N-I+2
      DO 24 J=L,N
   24 A(L-1,NY)=A(L-1,NY)-A(L-1,J)*A(J,NY)
      NTR=-1
      RES=SYY
      DO 25 I=1,NF
      RES=RES-A(I,NY)*F(I)
   25 F(I)=A(I,NY)
      NFUN=NP
      NDF=NP-NF+NC
      DF=NDF
      Y=FNC
      NTR=-1
      RETURN
      ENTRY STAT
      TOT=SYY-SY*SY/NP
      REG=TOT-CCC
      SYY=RES/NDF
      ST=1.96+2.72/DF+8.04/DF**3
      DET=1.
      DO 30 I=1,NF
      DET=DET*B  (I,I)
      IF(A(I,I).LE.0.0)GO TO 30
      A(I,I)=1./A(I,I)
   30 CONTINUE
      DO 32 I=2,NF
      DO 32 J=2,I
      SY=0.
      DO 31 K=J,I
   31 SY=SY-A(I,K-1)*A(K-1,J-1)
   32 A(I,J-1)=SY*A(I,I)
      PRINT 37
      DO 36 I=1,NF
      L=NF-I
      DO 33 J=1,L
      K=NF-J
      DO 33 M=1,J
      N=NF-M+1
   33 A(K,I)=A(K,I)-A(K,N)*A(N,I)
      DO 34 J=2,I
   34 A(J-1,I)=A(I,J-1)*SYY
      DO 35 J=1,I
   35 A(I,J)=A(I,J)*SYY
      BB=B(I,I)
      IF(BB.LT.0.0)BB=-BB
      FF=ST*SQRT(BB)
      BBB=B(I,NY)
   36 PRINT 371,BBB,FF
   37 FORMAT(*1THE COEFFICIENTS AND THEIR ESTIMATED ERRORS ARE0*//)
  371 FORMAT(E19.10,* +OR-*E9.2)
      IF(DDD.LT.0.0)DDD=-DDD
```

```
      DDD=SQRT(DDD)
      CORR=REG/TOT
      PRINT 38,CCC,REG,TOT,DDD,DET,CORR,NP
   38 FORMAT(*0*/*0*/*0ESTIMATED RESIDUAL SUM OF SQUARES =*E17.9/
     1                 * ESTIMATED REGRESSION SUM OF SQUARES =*E17.9/
     2                       * ESTIMATED TOTAL SUM OF SQUARES =*E17.9/
     1* VARIANCE OF FIT =*E17.9/* DETERMINANT OF THE MATRIX =*E17.9/
     4* CORRELATION COEFFICIENT =*E17.9/* NUMBER OF POINTS =*I5)
      Y=SQRT(CCC/DF)
      NFUN=NDF
      RETURN
   44 PRINT 45
   45 FORMAT(*1THE ARRAYS IN THE FITTING PROGRAM ARE TOO SMALL TO HOLD T
     1HE NUMBER OF CONSTRAINTS AND FUNCTIONS ASKED FOR IN THE CALLING PR
     2OGRAM*)
      STOP
      END


      FUNCTION FIND D(P,D,T)
      DIMENSION A(33),G(32)
      COMMON/DATA/A,G,PP,DD,TT,GAMMA,ID
      TYPE DOUBLE A,G,PP,DD,TT,GAMMA
      PP=P
      TT=T
      DD=D
      DO 10 I=1,50
      ID=1
      CALL PRESS
      P2=PP
      IF(ABSF(P-P2)-1.E-7*P)20,20,1
    1 CALL DPDD
      DP=PP
      CORR=(P2-P)/DP
      IF(ABSF(CORR)-1.E-7*D)20,20,10
   10 DD=DD-CORR
      FIND D=0
      RETURN
   20 FIND D=DD
      RETURN
      END



      FUNCTION INDEX(I,J)
      IF(I-1)13,13,2
    2 IFF=I/J
      IFF=IFF*J
      IF(I.EQ.IFF)GO TO 13
      INDEX=1
      RETURN
   13 INDEX=0
      RETURN
      END
```

```
      SUBROUTINE PROPS S
      DIMENSION X(33)
      DIMENSION B(33),G(32)
      COMMON/DATA/B,G,PP,DD,TT,GAMMA,ID
      TYPE DOUBLE B,G,PP,DD,TT,D,T,P,D2,D3,D4,D5,D6,D7,D8,D9,D10,D11,D12
     1,D13,TS,T2,T3,T4,T5,F ,F1,F21,F22,     F23,F24,F25,F26,GAMMA
      TYPE DOUBLE F212,F222,F232,F242,F252,F262
     1,F2,F3,F4,F33,F35,F37,F39,F311,F313,F43,F45,F47,F49,F411,F413
      TYPE DOUBLE G1,G2,G3,G4,G5,G6,X
      EQUIVALENCE (B,X)
      PROPS FOR H2 USING THE STEWART-JACOBSEN EQUATION
    1 CONTINUE
      R=8.205616D-2
      D=DD
      P=PP
      T=TT
      GM=GAMMA
      D2=D*D
      D3=D2*D
      D4=D3*D
      D5=D4*D
      D6=D5*D
      D7=D6*D
      D8=D7*D
      D9=D8*D
      D10=D9*D
      D11=D10*D
      D12=D11*D
      D13=D12*D
      TS=SQRTF(T)
      T2=T*T
      T3=T2*T
      T4=T3*T
      T5=T4*T
      F=EXPF(GM*D2)
      GO TO (100,200,300,400,500,600,700,800,900),K
      ENTRY PRESS
      K=1
      GO TO 1
  100 CONTINUE
      B( 1)=D2*T
      B( 2)=D2*TS
      B( 3)=D2
      B( 4)=D2/T
      B( 5)=D2/T2
      B( 6)=D3*T
      B( 7)=D3
      B( 8)=D3/T
      B( 9)=D3/T2
      B(10)=D4*T
      B(11)=D4
      B(12)=D4/T
      B(13)=D5
      B(14)=D6/T
      B(15)=D6/T2
```

```
      B(16)=D7/T
      B(17)=D8/T
      B(18)=D8/T2
      B(19)=D9/T2
      B(20)=D3*F/T2
      B(21)=D3*F/T3
      B(22)=D5*F/T2
      B(23)=D5*F/T4
      B(24)=D7*F/T2
      B(25)=D7*F/T3
      B(26)=D9*F/T2
      B(27)=D9*F/T4
      B(28)=D11*F/T2
      B(29)=D11*F/T3
      B(30)=D13*F/T2
      B(31)=D13*F/T3
      B(32)=D13*F/T4
      IF(ID.GT.0)GO TO 102
      B(33)=P-R*D*T
      RETURN
  102 P=0
      M=32
      DO 101 I=1,M
  101 P=P+B(I)*G(I)
      P=P+R*D*T
      PP=P
      RETURN
      ENTRY DPDD
      K=2
      GO TO 1
  200 CONTINUE
      F1=2.00*F*GM*D
      F21=3.000*F*D2 +F1*D3
      F22=5.000*F*D4 +F1*D5
      F23=7.000*F*D6 +F1*D7
      F24=9.000*F*D8 +F1*D9
      F25=11.00*F*D10+F1*D11
      F26=13.00*F*D12+F1*D13
      B( 1)=2.00*D*T
      B( 2)=2.00*D*TS
      B( 3)=2.00*D
      B( 4)=2.00*D/T
      B( 5)=2.00*D/T2
      B( 6)=3.00*D2*T
      B( 7)=3.00*D2
      B( 8)=3.00*D2/T
      B( 9)=3.00*D2/T2
      B(10)=4.00*D3*T
      B(11)=4.00*D3
      B(12)=4.00*D3/T
      B(13)=5.00*D4
      B(14)=6.00*D5/T
      B(15)=6.00*D5/T2
      B(16)=7.00*D6/T
      B(17)=8.00*D7/T
```

```
      B(18)=8.00*D7/T2
      B(19)=9.00*D8/T2
      B(20)=F21/T2
      B(21)=F21/T3
      B(22)=F22/T2
      B(23)=F22/T4
      B(24)=F23/T2
      B(25)=F23/T3
      B(26)=F24/T2
      B(27)=F24/T4
      B(28)=F25/T2
      B(29)=F25/T3
      B(30)=F26/T2
      B(31)=F26/T3
      B(32)=F26/T4
      M=32
      IF(ID.GT.0)GO TO 202
      B(33)=P-R*T
      RETURN
  202 P=0
      DO 201 I=1,M
  201 P=P+B(I)*G(I)
      P=P+R*T
      PP=P
      RETURN
      ENTRY DPDT
      K=3
      GO TO 1
  300 CONTINUE
      X( 1)=D2
      X( 2)=D2/(2.00*TS)
      X( 3)=0
      X( 4)=-D2/T2
      X( 5)=-2.00*D2/T3
      X( 6)=D3
      X( 7)=0
      X( 8)=-D3/T2
      X( 9)=-2.00*D3/T3
      X(10)=D4
      X(11)=0
      X(12)=-D4/T2
      X(13)=0
      X(14)=-D6/T2
      X(15)=-2.00*D6/T3
      X(16)=-D7/T2
      X(17)=-D8/T2
      X(18)=-2.00*D8/T3
      X(19)=-2.00*D9/T3
      X(20)=-2.00*D3*F/T3
      X(21)=-3.00*D3*F/T4
      X(22)=-2.00*D5*F/T3
      X(23)=-4.00*D5*F/T5
      X(24)=-2.00*D7*F/T3
      X(25)=-3.00*D7*F/T4
      X(26)=-2.00*D9*F/T3
```

```
      X(27)=-4.00*D9*F/T5
      X(28)=-2.00*D11*F/T3
      X(29)=-3.00*D11*F/T4
      X(30)=-2.00*D13*F/T3
      X(31)=-3.00*D13*F/T4
      X(32)=-4.00*D13*F/T5
      IF(ID.GT.0)GO TO 302
      X(33)=PP-R*D
      RETURN
  302 P=0
      DO 301 I=1,32
  301 P=P+G(I)*X(I)
      PP=P+R*D
      RETURN
      ENTRY DSDN
      K=4
      GO TO 1
  400 CONTINUE
C     S=S0-R*LOGF(D*R*T/P0)+(DSDN(D)-DSDN(0))*101.325 +CPOS(T)
      G1=F/(2.00*GM)
      G2=(F*D2-2.00*G1)/(2.00*GM)
      G3=(F*D4-4.00*G2)/(2.00*GM)
      G4=(F*D6-6.00*G3)/(2.00*GM)
      G5=(F*D8-8.00*G4)/(2.00*GM)
      G6=(F*D10-10.00*G5)/(2.00*GM)
      X( 1)=-D
      X( 2)=-D/(2.00*TS)
      X( 3)=0.D0
      X( 4)=+D/T2
      X( 5)=2.00*D/T3
      X( 6)=-D2/2.00
      X( 7)=0.D0
      X( 8)=D2/(2.00*T2)
      X( 9)=D2/T3
      X(10)=-D3/3.00
      X(11)=0.D0
      X(12)=D3/(3.00*T2)
      X(13)=0.D0
      X(14)=D5/(5.00*T2)
      X(15)= 2.00*D5/(5.00*T3)
      X(16)=D6/(6.00*T2)
      X(17)=D7/(7.00*T2)
      X(18)=2.00*D7/(7.00*T3)
      X(19)=D8/(4.00*T3)
      X(20)=2.00*G1/T3
      X(21)=3.00*G1/T4
      X(22)=2.00*G2/T3
      X(23)=4.00*G2/T5
      X(24)=2.00*G3/T3
      X(25)=3.00*G3/T4
      X(26)=2.00*G4/T3
      X(27)=4.00*G4/T5
      X(28)=2.00*G5/T3
      X(29)=3.00*G5/T4
      X(30)=2.00*G6/T3
```

```
      X(31)=3.00*G6/T4
      X(32)=4.00*G6/T5
      IF(ID.GT.0)GO TO 402
      RETURN
  402 P=0
      DO 401 I=1,32
  401 P=P+G(I)*X(I)
      PP=P
      RETURN
      ENTRY DUDN
      K=5
      GO TO 1
  500 CONTINUE
C     H=H0+(T*DSDN(D)-DSDN(0))*101.325+(DUDN(D-DUDN(0))*101.325+CPOH(T)
C     +(P/D-R*T)*101.325
      G1=F/(2.00*GM)
      G2=(F*D2-2.00*G1)/(2.00*GM)
      G3=(F*D4-4.00*G2)/(2.00*GM)
      G4=(F*D6-6.00*G3)/(2.00*GM)
      G5=(F*D8-8.00*G4)/(2.00*GM)
      G6=(F*D10-10.00*G5)/(2.00*GM)
      X( 1)=D*T
      X( 2)=D*TS
      X( 3)=D
      X( 4)=D/T
      X( 5)=D/T2
      X( 6)=D2*T/2.00
      X( 7)=D2/2.00
      X( 8)=D2/(2.00*T)
      X( 9)=D2/(2.00*T2)
      X(10)=D3*T/3.00
      X(11)=D3/3.00
      X(12)=D3/(3.00*T)
      X(13)=D4/4.00
      X(14)=D5/(5.00*T)
      X(15)=D5/(5.00*T2)
      X(16)=D6/(6.00*T)
      X(17)=D7/(7.00*T)
      X(18)=D7/(7.00*T2)
      X(19)=D8/(8.00*T2)
      X(20)=G1/T2
      X(21)=G1/T3
      X(22)=G2/T2
      X(23)=G2/T4
      X(24)=G3/T2
      X(25)=G3/T3
      X(26)=G4/T2
      X(27)=G4/T4
      X(28)=G5/T2
      X(29)=G5/T3
      X(30)=G6/T2
      X(31)=G6/T3
      X(32)=G6/T4
      IF(ID.GT.0)GO TO 502
      RETURN
```

```
  502 P=0
      DO 501 I=1,32
  501 P=P+G(I)*X(I)
      PP=P
      RETURN
      ENTRY TDSDT
      K=6
      GO TO 1
  600 CONTINUE
C     CV=CV0+(TDSDN(/)-TDSDN(D))*101.325
      G1=F/(2.00*GM)
      G2=(F*D2-2.00*G1)/(2.00*GM)
      G3=(F*D4-4.00*G2)/(2.00*GM)
      G4=(F*D6-6.00*G3)/(2.00*GM)
      G5=(F*D8-8.00*G4)/(2.00*GM)
      G6=(F*D10-10.00*G5)/(2.00*GM)
      X( 1)=0.D0
      X( 2)=-D/(4.00*TS)
      X( 3)=0.D0
      X( 4)=2.00*D/T2
      X( 5)=6.00*D/T3
      X( 6)=0.D0
      X( 7)=0.D0
      X( 8)=D2/T2
      X( 9)=3.00*D2/T3
      X(10)=0.D0
      X(11)=0.D0
      X(12)=(2.00*D3)/(3.00*T2)
      X(13)=0.D0
      X(14)=(2.00*D5)/(5.00*T2)
      X(15)=(6.00*D5)/(5.00*T3)
      X(16)=D6/(3.00*T2)
      X(17)=(2.00*D7)/(7.00*T2)
      X(18)=(6.00*D7)/(7.00*T3)
      X(19)=(3.00*D8)/(4.00*T3)
      X(20)=6.000*G1/T3
      X(21)=12.00*G1/T4
      X(22)=6.000*G2/T3
      X(23)=20.00*G2/T5
      X(24)=6.000*G3/T3
      X(25)=12.00*G3/T4
      X(26)=6.000*G4/T3
      X(27)=20.00*G4/T5
      X(28)=6.000*G5/T3
      X(29)=12.00*G5/T4
      X(30)=6.000*G6/T3
      X(31)=12.00*G6/T4
      X(32)=20.00*G6/T5
      IF(ID.GT.0)GO TO 602
      RETURN
  602 P=0
      DO 601 I=1,32
  601 P=P+G(I)*X(I)
      PP=P
      RETURN
```

```
      ENTRY DP2D2
      K=7
      GO TO 1
  700 CONTINUE
      F1=2.*F*GM*D
      F12=2.*F1*GM*D+2.*F*GM
      F212=3.*F1*D2+3.*2.*D*F+F12*D3+F1*3.*D2
      F222=5.*F1*D4 +5.*4.*D3*F+5.*D4*F1+F12*D5
      F232=7.*F1*D6+7.*6.*D5*F+7.*D6*F1+F12*D7
      F242=9.*F1*D8+9.*8.*D7*F+9.*D8*F1+F12*D9
      F252=11.*F1*D10+10.*11.*D9*F+11.*D10*F1+F12*D11
      F262=13.*F1*D12+13.*12.*D11*F+13.*D12*F1+F12*D13
      B(1)=2.*T  $B(2)=2.*TS  $  B(3)=2.
      B(4)=2./T  $  B(5)=2./T2  $  B(6)=6.*D*T
      B(7)=6.*D  $  B(8)=6.*D/T  $  B(9)=6.*D/T2
      B(10)=12.*D2*T  $  B(11)=12.*D2  $  B(12)=12.*D2/T
      B(13)=20.*D3  $  B(14)=30.*D4/T  $  B(15)=30.*D4/T2
      B(16)=42.*D5/T  $  B(17)=56.*D6/T  $  B(18)=56.*D6/T2
      B(19)=72.*D7/T2  $  B(20)=F212/T2  $  B(21)=F212/T3
      B(22)=F222/T2
      B(23)=F222/T4  $  B(24)=F232/T2  $  B(25)=F232/T3
      B(26)=F242/T2  $  B(27)=F242/T4  $  B(28)=F252/T2
      B(29)=F252/T3  $  B(30)=F262/T2  $  B(31)=F262/T3
      B(32)=F262/T4
      M=32
      IF(ID.GT.0)GO TO 702
      B(33)=PP
      RETURN
  702 P=0
      DO 701 I=1,M
  701 P=P+B(I)*G(I)
      PP=P
      RETURN
      ENTRY DP3D3
      K=8
      GO TO 1
  800 CONTINUE
      F1=2.*F*GM*D
      F2=2.*F*GM+GM*2.*D*F1
      F3=4.*F1*GM+GM*2.*D*F2
      F33=6.*F+18.*D*F1+9.*D2*F2+D3*F3
      F35=60.*D2*F+60.*D3*F1+15.*D4*F2+D5*F3
      F37=220.*D4*F+126.*D5*F1+21.*D6*F2+D7*F3
      F39=504.*D6*F+216.*D7*F1+27.*D8*F2+D9*F3
      F311=990.*D8*F+330.*D9*F1+33.*D10*F2+D11*F3
      F313=1716.*D10*F+468.*D11*F1+39.*D12*F2+D13*F3
      B(1)=0.0  $  B(2)=0.0  $  B(3)=0.0  $  B(4)=0.0  $  B(5)=0.0
      B(6)=6.*T  $  B(7)=6.  $  B(8)=6./T  $  B(9)=6./T2
      B(10)=24.*D*T  $  B(11)=24.*D  $  B(12)=24.*D/T
      B(13)=60.*D2  $  B(14)=120.*D3/T  $  B(15)=120.*D3/T2
      B(16)=210.*D4/T  $  B(17)=336.*D5/T  $  B(18)=336.*D5/T2
      B(19)=504.*D6/T2
      B(20)=F33/T2  $  B(21)=F33/T3  $  B(22)=F35/T2
      B(23)=F35/T4  $  B(24)=F37/T2  $  B(25)=F37/T3
      B(26)=F39/T2  $  B(27)=F39/T4  $  B(28)=F311/T2
```

```
      B(29)=F311/T3   $  B(30)=F313/T2
      B(31)=F313/T3   $  B(32)=F313/T4
      M=32
      IF(ID.GT.0)  GO TO 802
      B(33)=PP
      RETURN
  802 P=0
      DO 801 I=1,M
  801 P=P+B(I)*G(I)
      PP=P
      RETURN
      ENTRY DP4D4
      K=9
      GO TO 1
  900 CONTINUE
      F1=2.*F*GM*D
      F2=2.*F*GM+GM*2.*D*F1
      F3=4.*F1*GM+GM*2.*D*F2
      F4=6.*F2*GM+GM*2.*D*F3
      F43=24.*F1+36.*D*F2+12.*D2*F3+D3*F4
      F45=120.*D*F+240.*D2*F1+120.*D3*F2+20.*D4*F3+D5*F4
      F47=880.*D3*F+850.*D4*F1+252.*D5*F2+28.*D6*F3+D7*F4
      F49=3024.*D5*F+2016.*D6*F1+432.*D7*F2+36.*D8*F3+D9*F4
      F411=7920.*D7*F+3960.*D8*F1 +660.*D9*F2+44.*D10*F3+D11*F4
      F413=17160.*D9*F+6578.*D10*F1+936.*D11*F2+52.*D12*F3+D13*F4
      B(1)=0.0  $  B(2)=0.0  $  B(3)=0.0  $  B(4)=0.0  $  B(5)=0.0
      B(6)=0.0  $  B(7)=0.0  $  B(8)=0.0  $  B(9)=0.0
      B(10)=24.*T  $  B(11)=24.  $  B(12)=24./T
      B(13)=120.*D  $  B(14)=360.*D2/T  $  B(15)=360.*D2/T2
      B(16)=840.*D3/T  $  B(17)=1680.*D4/T  $  B(18)=1680.*D4/T2
      B(19)=3024.*D5/T2
      B(20)=F43/T2  $  B(21)=F43/T3  $  B(22)=F45/T2
      B(23)=F45/T4  $  B(24)=F47/T2  $  B(25)=F47/T3
      B(26)=F49/T2  $  B(27)=F49/T4  $  B(28)=F411/T2
      B(29)=F411/T3  $  B(30)=F413/T2  $  B(31)=F413   /T3
      B(32)=F413/T4
      M=32
      IF(ID.GT.0)GO TO 902
      B(33)=PP
      RETURN
  902 P=0
      DO 901 I=1,M
  901 P=P+B(I)*G(I)
      PP=P
      RETURN
      END
```

```
      SUBROUTINE GIBBS
      DIMENSION A(33),G(32)
      COMMON/DATA/A,G,PP,DD,TT,GAMMA,ID
      TYPE DOUBLE A,G,PP,DD,TT,GAMMA
      R=.08205616
      DQ=DD
      PQ=PP
      ID=1
      CALL DUDN
      U1=PP
      DD=0
      CALL DUDN
      U0=PP
      PP=U1-U0+PQ/DQ
      PP=PP+R*TT*LOGF(DQ*R*TT)
      DD=DQ
      RETURN
      END


      FUNCTION WEIGHT(DQ)
      DIMENSION G(32),A(33),F(40)
      COMMON/DATA/A,G,PP,DD,TT,GAMMA,ID
      TYPE DOUBLE A,G,PP,DD,TT,GAMMA,F,Y
      COMMON F,Y,NFUN
      SIGD=.001*DD
      SIGP=.01
      ID=1
      PQ=PP
      TQ=TT
      DQ=DD
      DCAL=FIND D(PQ,DQ,TQ)
      CALL PRESS
      PCAL=PP
      CALL DPDD
      DP=PP
      PP=PQ
      WEIGHT=SQRTF((((PCAL-PQ)*100./PQ)**2+((DCAL-DQ)*100./DQ)**2)/((SIG
     1D*DP)**2+SIGP**2+PQ **2))
      RETURN
      END


      FUNCTION VPN(T)
      DIMENSION G(5)
      DATA(G=3.05300134164,2.80810925813,-0.655461216567,1.59514439374,
     11.5814454428),(TC=32.938),(PR=0.0695),(TR=13.8)
      A=(1.-TR/T)/(1.-TR/TC)
      X=A*G(1)+A**2*G(2)+A**3*G(3)+A*((1.-A)**G(5))*G(4)
      VPN=PR*EXPF(X)
      RETURN
      END
```

```
      FUNCTION DSATV(T)
      DIMENSION GV(8),GL(7)
      DATA(GL=0.048645813003,-3.4779278186E-2,4.0776538192E-1,
     1-1.1719787304,1.62139244,-1.1531096683,0.33825492039)
      DATA(RHOC=0.03136),(BETAL=.34786027325),(TC=32.938)
      DATA(GV=-0.047501571529,3.4871213005E-2,-4.1221290925E-1,
     11.566659855,-2.8061427339,2.7105455626,-1.307477359,
     20.22921285922),(BETAV=.34831237625),(FACT=496.04651)
      A=(TC-T)/TC
      DV=RHOC+GV(1)*A**BETAV
      DO 1 I=1,7
    1 DV=DV+GV(I+1)*A**(1.+(I-1)/3.)
      DV=DV*FACT
      DSATV=DV
      RETURN
      ENTRY DSATL
      A=(TC-T)/TC
      DV=RHOC+GL(1)*A**BETAL
      DO 2 I=1,6
    2 DV=DV+GL(I+1)*A**(1.+(I-1)/3.)
      DV=DV*FACT
      DSATV=DV
      RETURN
      END


      FUNCTION DPDTVP(T)
      DIMENSION G(5)
      DATA(G=3.05300134164,2.80810925813,-0.655461216567,1.59514439374,
     11.5814454428),(TC=32.938),(PR=0.0695),(TR=13.8)
      A=(1.-TR/T)/(1.-TR/TC)
      DADT=(TR/T**2)/(1.-TR/TC)
      DPDT=G(1)*DADT+2.*G(2)*A*DADT+G(3)*3.*A**2*DADT+G(4)*((1.-A)**G(5)
     1)*DADT+G(4)*A*((1.-A)**(G(5)-1.))*G(5)*(-DADT)
      DPDT=DPDT*VPN(T)
      DPDTVP=DPDT
      RETURN
      END
```

```
      FUNCTION ATKINT(X,YMAT,XMAT,NELMTS,NMAX,NESSY,ACRCY)
C     THIS PROGRAM HAS BEEN CHANGED SO THAT THE OSCILLATING NATURE OF
C     THE MATRIX TO BE INTERPOLATED EXISTS ONLY AT THE UPPER END OF THE
C     TABLE
C     THIS ROUTINE WILL TAKE INPUT MATRICES OF UP TO 999 ELEMENTS EACH,
C     ARRANGED SO THAT THE X MATRIX(XMAT) IS IN EITHER ASCENDING OR
C     DESCENDING ORDER,SELECT NMAX OF THESE POINTS,CHOSEN SO THAT
C     SUCESSIVE X VALUES OSCILATE ABOUT THE VALUE OF THE ARGUMENT X
C     UNLESS THE ENDS OF THE XMATRIX INTERFERE (IN THIS CASE THE
C     OSCILATORY NATURE IS LOST BUT THE PROGRAM WILL STILL PERFORM AN
C     INTERPOLATION), INTERPOLATE ON THESE NMAX PAIRS OF DATA BY
C     AN OSCILATING VARIABLE POINT AITKEN INTERPOLATION ALGORITHM
C     EITHER UNTIL THE PERCENTAGE CHANGE IN THE INTERPOLANT IS LESS
C     THAN THE ACRCY ARGUMENT(THE ARGUMENT NESSY INDICATES THE
C     NUMBER OF THE POINT JUST BEFORE THE LAST ONE CHECKED) OR UNTIL
C     THE NMAX POINTS ARE ALL USED.  IT IS SUGGESTED THAT NMAX
C     BE LESS THAN 10, AND OF COURSE LESS THAN NELMTS.  NELMTS
C     INDICATES THE NUMBER OF ELEMENTS IN XMAT OR YMAT.
C     IF NESSY IS ZERO IT INDICATES THAT THE INTERPOLATION REQUIREMENT
C     HAS NOT BEEN SATISFIED.  IF NESSY IS 1 IT MEANS THAT THE VALUE OF
C     X LIES OUT SIDE THE RANGE OF XMAT.
      DIMENSION YMAT(999), XMAT(999),A(21,20)
  100 FORMAT(42HINTERPOLATION REQUIREMENT NOT SATISFIED(X=,E16.8,1H)/33H
     1LAST 2 APPROXIMATIONS OF Y ARE(Y=,E16.8,1H,,E16.8,1H))
  200 FORMAT(55HTHIS REPRESENTS AN EXTRAPOLATION OF THE  XMAT MATRIX(X=,
     1E16.8,1H)/33HNO CALCULATION HAS BEEN PERFORMED)
  300 FORMAT(24HNELMTS IS LESS THAN NMAX)
  400 FORMAT(22HNMAX IS LARGER THAN 20)
      IF(NMAX-20)71,71,69
   69 WRITE OUTPUT TAPE 6,400
      ATKINT=0.0
      RETURN
   71 IF(NMAX-NELMTS)75,75,73
   73 WRITE OUTPUT TAPE 6,300
      ATKINT=0.0
      RETURN
   75 CONTINUE
C     FIRST TWO SUCCESSIVE VALUES OF THE XMATRIX THAT STRADDLE THE
C     VALUE X WILL BE SOUGHT
      JJ1=NELMTS-1
      DO 20 I=1,JJ1
      DIF1=X-XMAT(I)
      DIF2=XMAT(I+1)-X
      IF(DIF1)16,15,16
   15 ATKINT=YMAT(I)
      NESSY =NMAX
      RETURN
   16 IF(DIF2)18,17,18
   17 ATKINT=YMAT(I+1)
      NESSY =NMAX
      RETURN
   18 RATIO=DIF1/ DIF2
      IF(RATIO)20,20,19
   19 IMID=I
      GO TO 32
```

```
   20 CONTINUE
C     AT THIS POINT ONE COULD PRINT THE FOLLOWING STATEMENT
C     WRITE OUTPUT TAPE 6,200,X
      NESSY=1
      ATKINT=0.0
      RETURN
   32 CONTINUE
C     NOTE THAT RATIO IS POSITIVE IF THE TWO POINTS STRADDLE X
C     REGARDLESS WHICH IS LARGER
      JJJ=IMID
      JUP=IMID
      JDN=IMID
      IF(JJJ+NMAX-NELMTS+1)98,98,102
   98 DO 201 J=1,NMAX
      JJJ=IMID+J-1
      A(1,J)=XMAT(JJJ)
  201 A(2,J)=YMAT(JJJ)
      GO TO 203
  102 DO 41 J=1,NMAX
      JJ=J/2
      JOE=J-2*JJ
C     JOE IS 0 IF J IS EVEN AND 1 IF J IS ODD
      IF(J-1)33,40,33
   33 IF(JDN-1)34,36,34
   34 IF(JUP-NELMTS)35,37,35
   35 IF(JOE)37,36,37
   36 JUP=JUP+1
      JJJ=JUP
      GO TO 40
   37 JDN=JDN-1
      JJJ=JDN
      GO TO 40
   40 A(1,J)=XMAT(JJJ)
      A(2,J)=YMAT(JJJ)
   41 CONTINUE
  203 NNN=NMAX+1
      DO 6 J=3,NNN
      L=J-1
      DO 5 K=L,NMAX
C     J IS THE COLUMN NUMBER
C     K IS THE ROW NUMBER
      UA(J,K)=(A(J-1,K)-A(J-1,J-2))*(X-A(1,J-2))/(A(1,K)-A(1,J-2))
     1       +A(J-1,J-2)
      IF(K-L)3,2,3
    2 IF(ABSF((A(J,L)-A(J-1,L-1))/A(J,L))-ACRCY/100.0)7,7,3
    3 CONTINUE
    5 CONTINUE
    6 CONTINUE
      NESSY=0
C     AT THIS POINT ONE COULD PRINT OUT THE FOLLOWING STATEMENT.
C     WRITE OUTPUT TAPE 6,100,X,A(NNN,NMAX),A(NNN-1,NMAX-1)
      ATKINT=A(NNN,NMAX)
      RETURN
    7 NESSY=J-1
      ATKINT=A(J,J)

      RETURN
      END
```

```
      FUNCTION CPO(TI,N)
      DIMENSION T(58),CPP(58),CPN(58),CPO(58),CPE(58)
      COMMON/PARA/,PERCEN
C     CALCULATES IDESL GAS SPECIFIC HEAT FOR H2 BY INTERPOLATING
C     DATA TAKEN FROM RP 1932, UNITS OF THE TABLES ARE  CAL/MOL DEG 5.
C     UNITS OF OUTPUT ARE JOULES/MOL DEG K.  THE INDEX N DETERMINES THE
C     SPECIES,FOR N=1,PARAHYDROGEN,N=2 NORMAL, N=3 ORTHO, N=4 EQUILIB
C     N=5,SOME ORTHO-PARA MIXTURE SPECIFIED BY COMMON /PARA/,PERCENT
C     RANGE OF TEMP IS FROM 10 TO 5000K.
      DATA(T=
     1 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0,
     2 50.0, 55.0, 60.0, 65.0, 70.0, 75.0, 80.0, 85.0, 90.0, 95.0,100.0,
     3105.0,110.0,115.0,120.0,125.0,130.0,135.0,140.0,145.0,150.0,160.0,
     4170.0,180.0,190.0,200.0,210.0,220.0,230.0,240.0,250.0,260.0,270.0,
     5280.0,290.0,300.0,350.0,400.0,500.0,600.,700.,1000.,1500.,2000.,
     63000.,4000.,5000.)
      DATA((CPE(I),I=1,58)=4.968   ,4.96884,4.97647,5.01153,5.07451,5.208
     11,5.83508,6.81282,7.87989,8.60613,9.00231,9.08005,8.93278,8.65894,
     28.33603,8.01207,7.71009,7.4416,7.21109,7.01858,6.85857,6.72557,6.6
     32055,6.53555,6.46904,6.42003,6.38403,6.36151,6.34602,6.33753,6.340
     401,6.34577,6.37276,6.413,6.45925,6.50975,6.5605,6.6095,6.65724,
     7                                        6.692,6.734,6.771,6.804,6.832,
     56.856,6.877,6.895,6.950,6.974,6.993,7.009,7.036,7.219,7.720,8.195,
     68.859,9.342,9.748)
      DATA(CPO=
     14.968,4.968,4.968,4.968,4.968,4.968,4.968,4.968,4.968,4.968,4.968,
     24.968,4.968,4.968,4.969,4.972,4.975,4.981,4.990,5.002,5.018,5.039,
     35.064,5.094,5.129,5.169,5.213,5.261,5.313,5.369,5.427,5.487,5.612,
     45.741,5.868,5.992,6.109,6.219,6.320,6.411,6.493,6.566,6.629,6.684,
     56.732,6.773,6.808,6.917,6.962,6.993,7.009,7.036,7.219,7.720,8.195,
     68.859,9.342,9.748)
      DATA(CPP=
     14.968,4.968,4.968,4.968,4.968,4.968,4.968,4.968,4.969,4.972,4.983,
     25.006,5.048,5.114,5.207,5.328,5.475,5.646,5.835,6.036,6.245,6.454,
     36.659,6.854,7.037,7.203,7.351,7.480,7.590,7.681,7.753,7.807,7.870,
     47.883,7.858,7.808,7.742,7.667,7.591,7.516,7.445,7.380,7.322,7.270,
     57.225,7.186,7.152,7.050,7.010,6.998,7.010,7.037,7.219,7.720,8.159,
     68.859,9.342,9.748)
      DATA(CPN=
     14.968,4.968,4.968,4.968,4.968,4.968,4.968,4.968,4.968,4.969,4.972,
     24.977,4.988,5.005,5.029,5.061,5.100,5.147,5.201,5.261,5.325,5.393,
     35.463,5.534,5.606,5.677,5.748,5.816,5.882,5.947,6.008,6.067,6.177,
     46.276,6.366,6.446,6.517,6.581,6.638,6.687,6.731,6.769,6.802,6.831,
     56.855,6.876,6.894,6.950,6.974,6.993,7.009,7.036,7.219,7.720,8.195,
     68.859,9.342,9.748)
      GO TO(1,2,3,4,5),N
    1 CPO=ATKINT(TI,CPP,T,58, 6,NES,.01)*4.184
      RETURN
    2 CPO=ATKINT(TI,CPN,T,58, 6,NES,.01)*4.184
      RETURN
    3 CPO=ATKINT(TI,CPO,T,58, 6,NES,.01)*4.184
      RETURN
    4 CPO=ATKINT(TI,CPE,T,58, 6,NES,.01)*4.184
      RETURN
    5 TUP=TI+.5
      TDN=TI-.5
      HUP=CPOH(TUP,5)
      HDN=CPOH(TDN,5)
      CPO=(HUP-HDN)
      RETURN
      END
```

```
      FUNCTION CPOH(TI,N)
      DIMENSION T(58),HP(58),HN(58),HO(58),HE(58)
      COMMON/PARA/,PERCEN
C     CALCULATES THE ENTHALPY OF THE IDEAL GAS FOR H2 BY INTERPOLATION
C     DATA TAKEN FROM RP 1932, UNITS OF TABLES ARE CAL/MOL
C     UNITS OF OUTPUT ARE JOULE/MOL.  THE INDEX N DETERMINES THE SPECIES
C     SPECIES,FOR N=1,PARAHYDROGEN,N=2 NORMAL, N=3 ORTHO, N=4 EQUILIB
C     N=5,SOME ORTHO-PARA MIXTURE SPECIFIED BY COMMON /PARA/,PERCENT
C     RANGE OF TEMP IS FROM 10 TO 5000K.
      DATA(T=
     1 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0,
     2 50.0, 55.0, 60.0, 65.0, 70.0, 75.0, 80.0, 85.0, 90.0, 95.0,100.0,
     3105.0,110.0,115.0,120.0,125.0,130.0,135.0,140.0,145.0,150.0,160.0,
     4170.0,180.0,190.0,200.0,210.0,220.0,230.0,240.0,250.0,260.0,270.0,
     5280.0,290.0,300.0,350.0,400.0,500.0,600.,700.,1000.,1500.,2000.,
     63000.,4000.,5000.)
      DATA(HN=
     1 303.67, 313.60, 323.54, 333.48, 343.41, 353.35, 378.19, 403.03,
     1 427.86, 452.71, 477.56, 502.43, 527.34, 552.32, 577.40, 602.62,
     3 628.02, 653.64, 679.51, 705.66, 732.13, 758.92, 786.06, 813.55,
     4 841.40, 869.61, 898.17, 927.08, 956.33, 985.91,1015.80,1045.99,
     51107.22,1169.49,1232.71,1296.78,1361.60,1427.10,1493.20,1559.84,
     61626.93,1694.44,1762.30,1830.48,1898.91,1967.57,2036.43,2382.74,
     72730.94,3429.46,4129.51,4831.66,6966.23,10697.2,14679.2,
     823230.9,32345.,41895.)
      DATA(HP=
     1  49.68,  59.61,  69.55,  79.49,  89.42,  99.36, 124.20, 149.04,
     2 173.88, 198.73, 223.61, 248.58, 273.71, 299.11, 324.90, 351.22,
     3 378.22, 406.01, 434.71, 464.38, 495.09, 526.84, 559.62, 593.41,
     4 628.14, 663.75, 700.14, 737.23, 774.92, 813.10, 851.69, 890.60,
     5 969.04,1047.84,1126.58,1204.93,1282.69,1359.74,1436.03,1511.56,
     61586.36,1660.49,1733.99,1806.95,1879.42,1951.47,2023.15,2377.83,
     72729.17,3429.24,4129.48,4831.65,6966.23,10697.2,14679.2,
     823230.9,32345.,41895.)
      DATA(HO=
     1 388.33, 398.27, 408.20, 418.14, 428.07, 438.01, 462.85, 487.69,
     2 512.53, 537.37, 562.21, 587.05, 611.89, 636.73, 661.57, 686.42,
     3 711.29, 736.18, 761.11, 786.09, 811.14, 836.28, 861.54, 886.93,
     4 912.49, 938.23, 964.18, 990.37,1016.80,1043.51,1070.50,1097.78,
     51153.27,1210.04,1268.09,1327.39,1387.91,1449.56,1512.26,1575.93,
     61640.46,1705.76,1771.74,1838.32,1905.41,1972.94,2040.86,2384.38,
     72731.52,3429.53,4129.52,4831.66,6966.23,10697.2,14679.2,
     823230.9,32345.,41895.)
      DATA(HE=
     1  49.68,  59.62,  69.57,  79.56,  89.66,  99.96, 127.50, 159.12,
     2 195.77, 236.90, 280.97, 326.24, 371.33, 415.35, 457.86, 498.74,
     3 538.05, 575.93, 612.56, 648.13, 682.82, 716.78, 750.14, 783.03,
     4 815.54, 847.76, 879.77, 911.63, 943.40, 975.11,1006.80,1038.52,
     51102.11,1166.03,1230.39,1295.23,1360.58,1426.43,1492.76,1559.55,
     61626.75,1694.32,1762.23,1830.43,1898.88,1967.55,2036.42,2382.74,
     72730.94,3429.46,4129.51,4831.66,6966.23,10697.2,14679.2,
     823230.9,32345.,41895.)
      GO TO(1,2,3,4,5),N
    1 CPOH=ATKINT(TI,HP,T,58, 6,NES,.01)*4.184
      RETURN
```

```
    2 CPOH=ATKINT(TI,HN,T,58, 6,NES,.01)*4.184
      RETURN
    3 CPOH=ATKINT(TI,HO,T,58, 6,NES,.01)*4.184
      RETURN
    4 CPOH=ATKINT(TI,HE,T,58,6 ,NES,.01)*4.184
      RETURN
    5 PERCENT=PERCEN /100.
      CPOH=(ATKINT(TI,HO,T,58,6,NES,.01)*(1.-PERCENT)+
     1ATKINT(TI,HP,T,58,6,NES,.01)*PERCENT)*4.184
      RETURN
      END
```

```
      FUNCTION CPOS(TI,N)
      DIMENSION T(60),SP(60),SN(60),SO(60),SE(60)
      COMMON/PARA/,PERCEN
C     CALCULATES  THE ENTROPY OF THE IDEAL GAS FOR H2 BY INTERPOLATING
C     DAKEN FROM RP 1932, UNITS OF THE TABLES ARE CAL/MOL DEG K.  1
C     UNITS OF OUTPUT ARE JOULES/MOL DEG K.  THE INDEX N DETERMINES THE
C     SPECIES,FOR N=1,PARAHYDROGEN,N=2 NORMAL, N=3 ORTHO, N=4 EQUILIB
C     N=5,SOME ORTHO-PARA MIXTURE SPECIFIED BY COMMON /PARA/,PERCENT
C     RANGE OF TEMP IS FROM 10 TO 5000K.
      DATA(T=
     1 10.0, 12.0, 14.0, 16.0, 18.0, 20.0, 25.0, 30.0, 35.0, 40.0, 45.0,
     2 50.0, 55.0, 60.0, 65.0, 70.0, 75.0, 80.0, 85.0, 90.0, 95.0,100.0,
     3105.0,110.0,115.0,120.0,125.0,130.0,135.0,140.0,145.0,150.0,160.0,
     4170.0,180.0,190.0,200.0,210.0,220.0,230.0,240.0,250.0,260.0,270.0,
     5280.0,290.0,300.0,350.0,400.0,450.0,500.0,550.0,600.0,700.,1000.,
     61500.,2000.,3000.,4000.,5000.)
      DATA(SP=
     U11.214,12.120,12.886,13.549,14.135,14.658,15.766,16.672,17.438,
     I18.102,18.688,19.214,19.693,20.135,20.548,20.938,21.310,21.669,
     O22.017,22.356,22.688,23.014,23.334,23.648,23.957,24.260,24.557,
     424.848,25.132,25.410,25.681,25.945,26.451,26.929,27.379,27.802,
     528.201,28.577,28.932,29.268,29.586,29.889,30.177,30.452,30.716,
     630.969,31.212,32.305,33.244,34.069,34.806,35.473,36.082,37.165,
     739.701,42.720,45.007,51.221,53.839,55.969)
      DATA(SO=
     115.581,16.486,17.252,17.916,18.501,19.024,20.133,21.038,21.804,
     222.468,23.053,23.576,24.050,24.482,24.880,25.248,25.591,25.912,
     326.215,26.500,26.771,27.029,27.275,27.512,27.739,27.958,28.170,
     428.375,28.575,28.769,28.958,29.143,29.502,29.846,30.177,30.498,
     530.808,31.109,31.401,31.684,31.958,32.225,32.484,32.735,32.979,
     633.216,33.446,34.505,35.432,36.253,36.989,37.656,38.265,39.348,
     741.884,44.903,47.190,51.221,53.839,55.969)
      DATA(SN=
     115.607,16.512,17.278,17.941,18.527,19.050,20.159,21.064,21.830,
     222.494,23.079,23.603,24.078,24.513,24.914,25.288,25.638,25.969,
     326.283,26.582,26.868,27.143,27.407,27.663,27.911,28.151,28.384,
     428.611,28.832,29.047,29.256,29.461,29.856,30.234,30.595,30.942,
     531.274,31.594,31.901,32.197,32.483,32.758,33.025,33.282,33.531,
     733.772,34.005,35.073,36.103,36.825,37.561,38.228,38.836,39.920,
     742.455,45.475,47.762,51.221,53.839,55.969)
```

```
      DATA(SE=
     111.215,12.120,12.887,13.554,14.149,14.692,15.918,17.069,18.196,
     219.294,20.331,21.285,22.145,22.911,23.592,24.198,24.740,25.229,
     325.674,26.080,26.455,26.804,27.129,27.435,27.724,27.999,28.260,
     428.510,28.750,28.980,29.203,29.418,29.828,30.216,30.584,30.934,
     531.269,31.591,31.899,32.196,32.482,32.758,33.024,33.282,33.531,
     633.772,34.005,35.073,36.003,36.825,37.561,38.228,38.836,39.920,
     742.455,45.475,47.762,51.221,53.839,55.969)
      GO TO(1,2,3,4,5),N
    1 CPOS=ATKINT(TI,SP,T,60, 6,NES,.01)*4.184
      RETURN
    2 CPOS=ATKINT(TI,SN,T,60, 6,NES,.01)*4.184
      RETURN
    3 CPOS=ATKINT(TI,SO,T,60, 6,NES,.01)*4.184
      RETURN

    4 CPOS=ATKINT(TI,SE,T,60, 6,NES,.01)*4.184
      RETURN
    5 PERCENT=PERCEN /100.
      CPOS=(ATKINT(TI,SO,T,60,6,NES,.01)*(1.-PERCENT)+
     1ATKINT(TI,SP,T,60,6,NES,.01)*PERCENT)*4.184
      RETURN
      END
```

12.670 15.556 32.938

THE COEFFICIENTS AND THEIR ESTIMATED ERRORS ARE0

```
 9.7724756841-004 +OR- 1.33-004
 2.7152251047-002 +OR- 3.28-003
-4.0181051493-001 +OR- 2.87-002
 1.6841979481+000 +OR- 7.88-001
-2.1489533487+001 +OR- 1.10+001
-1.6675599518-006 +OR- 9.30-006
 8.4131860302-003 +OR- 2.61-003
-5.7557476830-001 +OR- 1.95-001
 2.1149417739+002 +OR- 1.05+002
 1.2387354960-006 +OR- 3.43-007
-3.1280580947-004 +OR- 1.44-004
 2.5945419913-002 +OR- 1.29-002
 5.2494587855-006 +OR- 1.85-006
-9.5113449800-007 +OR- 1.89-005
-7.2316698085-003 +OR- 3.56-003
-3.8383727284-007 +OR- 5.81-007
 6.1714686495-009 +OR- 5.45-009
 5.0101024725-006 +OR- 2.45-006
-5.5717474190-008 +OR- 2.70-008
-1.8913610938+002 +OR- 1.04+002
-3.7831399504+002 +OR- 6.92+001
-8.4616109347-001 +OR- 4.18-001
 1.3760409852+001 +OR- 3.11+000
-1.1323039340-003 +OR- 5.69-004
 1.3554583722-003 +OR- 5.10-004
-1.8443884951-006 +OR- 8.89-007
-5.1666928690-005 +OR- 1.30-005
-2.9044621463-010 +OR- 1.77-010
 5.0870054382-009 +OR- 2.40-009
-1.0229323667-012 +OR- 5.05-013
-2.0248578837-012 +OR- 1.47-012
 1.1900504363-011 +OR- 4.60-012
```

ESTIMATED RESIDUAL SUM OF SQUARES = 4.439150815-007
ESTIMATED REGRESSION SUM OF SQUARES = 9.222196460-002
ESTIMATED TOTAL SUM OF SQUARES = 9.222240851-002
VARIANCE OF FIT = 1.675123034-005
DETERMINANT OF THE MATRIX = 4.084268136+088
CORRELATION COEFFICIENT = 9.999951865-001
NUMBER OF POINTS = 1611

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
1.783	1.085	23.0086	1.798	1.0816	-0.256	0.30
1.878	1.085	24.0083	1.883	1.0815	-0.261	0.30
1.972	1.085	25.0078	1.977	1.0815	-0.255	0.29
2.066	1.085	26.0073	2.072	1.0814	-0.256	0.29
2.160	1.084	27.0071	2.165	1.0815	-0.235	0.26
2.254	1.084	28.0071	2.259	1.0815	-0.228	0.25
2.347	1.084	29.0073	2.352	1.0815	-0.219	0.24
2.440	1.084	30.0076	2.445	1.0816	-0.204	0.22
2.533	1.084	31.0080	2.538	1.0816	-0.197	0.21
2.626	1.084	32.0084	2.631	1.0817	-0.180	0.20
2.719	1.084	33.0090	2.723	1.0818	-0.163	0.18
2.812	1.084	34.0099	2.816	1.0819	-0.144	0.15
2.904	1.083	35.0110	2.908	1.0819	-0.136	0.15
2.997	1.083	36.0122	3.000	1.0820	-0.120	0.13
3.089	1.083	37.0133	3.092	1.0820	-0.108	0.12
3.181	1.083	38.0142	3.184	1.0820	-0.098	0.10
3.273	1.083	39.0149	3.276	1.0819	-0.090	0.10
3.366	1.083	40.0154	3.368	1.0820	-0.075	0.08
3.550	1.083	42.0158	3.552	1.0819	-0.059	0.06
3.733	1.082	44.0155	3.735	1.0817	-0.053	0.06
3.916	1.082	46.0148	3.918	1.0816	-0.043	0.05
4.099	1.082	48.0142	4.101	1.0814	-0.039	0.04
4.282	1.082	50.0131	4.234	1.0812	-0.030	0.03
4.738	1.081	55.0071	4.739	1.0807	-0.018	0.02
5.193	1.080	59.9992	5.194	1.0802	-0.010	0.01
5.648	1.080	64.9999	5.648	1.0796	-0.003	0.00
6.101	1.079	70.0003	6.102	1.0789	-0.006	0.01
6.553	1.078	74.9944	6.554	1.0782	-0.014	0.01
7.005	1.078	79.9910	7.005	1.0777	-0.003	0.00
7.457	1.077	84.9971	7.457	1.0770	-0.004	0.00
7.907	1.076	90.0096	7.909	1.0762	-0.016	0.02
8.356	1.076	95.0121	8.359	1.0754	-0.027	0.03
8.805	1.075	100.0099	8.807	1.0748	-0.029	0.03
2.459	1.497	24.0083	2.464	1.4936	-0.194	0.24
2.592	1.497	25.0078	2.598	1.4931	-0.216	0.26
2.726	1.497	26.0073	2.731	1.4930	-0.214	0.26
2.858	1.497	27.0071	2.864	1.4927	-0.225	0.27
2.990	1.497	28.0071	2.996	1.4929	-0.209	0.24
3.121	1.496	29.0073	3.127	1.4927	-0.214	0.25
3.251	1.496	30.0076	3.258	1.4923	-0.226	0.26
3.382	1.496	31.0080	3.389	1.4926	-0.204	0.23
3.513	1.496	32.0084	3.519	1.4929	-0.178	0.20
3.643	1.496	33.0090	3.649	1.4927	-0.178	0.20
3.773	1.496	34.0099	3.779	1.4929	-0.157	0.17
3.903	1.495	35.0110	3.908	1.4929	-0.148	0.16
4.032	1.495	36.0122	4.038	1.4930	-0.134	0.15
4.162	1.495	37.0133	4.167	1.4932	-0.113	0.12
4.291	1.495	38.0142	4.296	1.4931	-0.105	0.11
4.421	1.495	39.0149	4.425	1.4932	-0.092	0.10

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
4.550	1.495	40.0154	4.553	1.4932	-0.079	0.09
4.807	1.494	42.0158	4.810	1.4931	-0.066	0.07
5.064	1.494	44.0155	5.067	1.4931	-0.046	0.05
5.320	1.493	46.0148	5.323	1.4927	-0.043	0.05
5.576	1.493	48.0142	5.578	1.4925	-0.036	0.04
5.832	1.493	50.0131	5.834	1.4924	-0.022	0.02
6.471	1.492	55.0071	6.470	1.4919	0.003	-0.00
7.106	1.491	59.9992	7.106	1.4911	0.010	-0.01
7.741	1.490	64.9999	7.740	1.4901	0.003	-0.00
8.375	1.489	70.0003	8.374	1.4893	0.007	-0.01
9.005	1.488	74.9944	9.006	1.4882	-0.004	0.00
9.635	1.487	79.9910	9.636	1.4872	-0.010	0.01
10.265	1.486	84.9971	10.267	1.4862	-0.016	0.02
10.894	1.486	90.0096	10.897	1.4851	-0.028	0.03
11.521	1.485	95.0121	11.525	1.4841	-0.037	0.04
12.146	1.484	100.0099	12.151	1.4830	-0.046	0.05
3.644	2.161	26.0073	3.648	2.1581	-0.088	0.12
3.843	2.160	27.0071	3.847	2.1570	-0.119	0.16
4.040	2.160	28.0071	4.045	2.1565	-0.134	0.17
4.235	2.160	29.0073	4.242	2.1557	-0.155	0.19
4.430	2.160	30.0076	4.437	2.1555	-0.159	0.20
4.624	2.159	31.0080	4.631	2.1553	-0.159	0.19
4.817	2.159	32.0084	4.825	2.1550	-0.161	0.19
5.010	2.159	33.0090	5.018	2.1551	-0.152	0.18
5.203	2.159	34.0099	5.210	2.1551	-0.142	0.17
5.395	2.158	35.0110	5.402	2.1553	-0.127	0.15
5.587	2.158	36.0122	5.594	2.1554	-0.114	0.13
5.779	2.158	37.0133	5.785	2.1554	-0.105	0.12
5.970	2.158	38.0142	5.975	2.1556	-0.083	0.09
6.161	2.157	39.0149	6.166	2.1557	-0.069	0.08
6.352	2.157	40.0154	6.356	2.1556	-0.065	0.07
6.732	2.157	42.0158	6.735	2.1556	-0.042	0.05
7.111	2.156	44.0155	7.113	2.1553	-0.032	0.04
7.489	2.156	46.0148	7.491	2.1551	-0.022	0.02
7.867	2.155	48.0142	7.868	2.1548	-0.010	0.01
8.244	2.155	50.0131	8.244	2.1545	-0.002	0.00
9.184	2.153	55.0071	9.182	2.1537	0.022	-0.02
10.119	2.152	59.9992	10.117	2.1524	0.019	-0.02
11.054	2.151	64.9999	11.051	2.1511	0.022	-0.02
11.984	2.149	70.0003	11.984	2.1494	0.006	-0.01
12.912	2.148	74.9944	12.913	2.1480	-0.003	0.00
13.839	2.147	79.9910	13.840	2.1465	-0.008	0.01
14.763	2.145	84.9971	14.767	2.1449	-0.024	0.02
15.687	2.144	90.0096	15.693	2.1433	-0.036	0.04
16.608	2.143	95.0121	16.616	2.1417	-0.046	0.05
17.526	2.141	100.0099	17.535	2.1402	-0.056	0.06
4.364	2.566	27.0071	4.364	2.5664	-0.002	0.00
4.603	2.566	28.0071	4.605	2.5646	-0.042	0.06
4.840	2.566	29.0073	4.844	2.5631	-0.081	0.11
5.076	2.566	30.0076	5.081	2.5624	-0.093	0.12

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
5.311	2.565	31.0080	5.316	2.5617	-0.108	0.14
5.544	2.565	32.0084	5.550	2.5615	-0.108	0.14
5.777	2.565	33.0090	5.784	2.5611	-0.111	0.14
6.009	2.564	34.0099	6.016	2.5610	-0.109	0.13
6.242	2.564	35.0110	6.248	2.5611	-0.095	0.11
6.473	2.564	36.0122	6.479	2.5613	-0.081	0.10
6.704	2.563	37.0133	6.709	2.5611	-0.078	0.09
6.934	2.563	38.0142	6.939	2.5612	-0.065	0.08
7.164	2.563	39.0149	7.168	2.5611	-0.056	0.07
7.393	2.562	40.0154	7.397	2.5611	-0.047	0.05
7.851	2.562	42.0158	7.854	2.5609	-0.032	0.04
8.308	2.561	44.0155	8.309	2.5608	-0.015	0.02
8.763	2.561	46.0148	8.763	2.5605	-0.003	0.00
9.217	2.560	48.0142	9.217	2.5599	-0.001	0.00
9.670	2.559	50.0131	9.669	2.5596	0.009	-0.01
10.800	2.558	55.0071	10.797	2.5583	0.021	-0.02
11.924	2.556	59.9992	11.921	2.5569	0.025	-0.03
13.047	2.555	64.9999	13.045	2.5551	0.019	-0.02
14.166	2.553	70.0003	14.165	2.5534	0.010	-0.01
15.280	2.552	74.9944	15.281	2.5514	-0.005	0.01
16.393	2.550	79.9910	16.395	2.5497	-0.011	0.01
17.505	2.548	84.9971	17.508	2.5479	-0.016	0.02
18.615	2.547	90.0096	18.621	2.5460	-0.032	0.03
19.720	2.545	95.0121	19.728	2.5441	-0.043	0.04
20.821	2.544	100.0099	20.833	2.5422	-0.055	0.06
5.505	3.333	28.0071	5.501	3.3369	0.076	-0.12
5.825	3.332	29.0073	5.824	3.3330	0.012	-0.02
6.142	3.332	30.0076	6.144	3.3305	-0.032	0.05
6.457	3.332	31.0080	6.461	3.3286	-0.064	0.09
6.770	3.331	32.0084	6.776	3.3275	-0.082	0.11
7.082	3.331	33.0090	7.089	3.3269	-0.088	0.12
7.393	3.330	34.0099	7.400	3.3263	-0.095	0.12
7.703	3.330	35.0110	7.710	3.3264	-0.085	0.11
8.012	3.330	36.0122	8.018	3.3262	-0.081	0.10
8.321	3.329	37.0133	8.326	3.3265	-0.064	0.08
8.628	3.329	38.0142	8.633	3.3264	-0.058	0.07
8.934	3.328	39.0149	8.939	3.3263	-0.050	0.06
9.240	3.328	40.0154	9.244	3.3263	-0.040	0.05
9.849	3.327	42.0158	9.852	3.3260	-0.028	0.03
10.457	3.326	44.0155	10.458	3.3258	-0.010	0.01
11.062	3.325	46.0148	11.062	3.3254	0.001	-0.00
11.666	3.325	48.0142	11.665	3.3249	0.009	-0.01
12.269	3.324	50.0131	12.267	3.3244	0.019	-0.02
13.771	3.322	55.0071	13.766	3.3231	0.038	-0.04
15.265	3.320	59.9992	15.258	3.3212	0.044	-0.05
16.755	3.318	64.9999	16.749	3.3187	0.033	-0.03
18.240	3.316	70.0003	18.236	3.3163	0.021	-0.02
19.718	3.313	74.9944	19.717	3.3137	0.006	-0.01
21.194	3.311	79.9910	21.194	3.3115	0.002	-0.00
22.666	3.309	84.9971	22.670	3.3087	-0.019	0.02

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PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
24.136	3.307	90.0096	24.145	3.3060	-0.036	0.04
25.601	3.305	95.0121	25.613	3.3037	-0.044	0.04
27.059	3.303	100.0099	27.076	3.3010	-0.062	0.06
6.509	3.982	29.0073	6.502	3.9904	0.115	-0.20
6.901	3.982	30.0076	6.897	3.9858	0.058	-0.09
7.287	3.981	31.0080	7.288	3.9812	-0.005	0.01
7.673	3.981	32.0084	7.675	3.9797	-0.022	0.03
8.056	3.980	33.0090	8.059	3.9785	-0.034	0.05
8.436	3.980	34.0099	8.440	3.9774	-0.046	0.06
8.816	3.979	35.0110	8.820	3.9772	-0.042	0.06
9.193	3.979	36.0122	9.197	3.9766	-0.045	0.06
9.570	3.978	37.0133	9.574	3.9765	-0.038	0.05
9.945	3.978	38.0142	9.948	3.9764	-0.029	0.04
10.319	3.977	39.0149	10.322	3.9762	-0.025	0.03
10.692	3.977	40.0154	10.694	3.9761	-0.016	0.02
11.436	3.976	42.0158	11.436	3.9758	-0.001	0.00
12.177	3.975	44.0155	12.175	3.9754	0.010	-0.01
12.914	3.974	46.0148	12.912	3.9748	0.019	-0.02
13.650	3.973	48.0142	13.647	3.9740	0.025	-0.03
14.385	3.972	50.0131	14.380	3.9734	0.034	-0.04
16.213	3.969	55.0071	16.205	3.9714	0.048	-0.05
18.031	3.967	59.9992	18.022	3.9688	0.047	-0.05
19.845	3.964	64.9999	19.837	3.9661	0.040	-0.04
21.651	3.962	70.0003	21.646	3.9628	0.022	-0.02
23.448	3.959	74.9944	23.447	3.9596	0.003	-0.00
25.245	3.957	79.9910	25.244	3.9570	0.002	-0.00
27.031	3.954	84.9971	27.039	3.9532	-0.029	0.03
28.821	3.952	90.0096	28.832	3.9504	-0.040	0.04
30.600	3.949	95.0121	30.616	3.9473	-0.053	0.05
32.369	3.947	100.0099	32.394	3.9439	-0.076	0.08
7.803	4.966	30.0076	7.796	4.9753	0.091	-0.18
8.309	4.966	31.0080	8.305	4.9692	0.040	-0.07
8.808	4.965	32.0084	8.808	4.9642	-0.008	0.01
9.303	4.964	33.0090	9.306	4.9612	-0.037	0.06
9.794	4.964	34.0099	9.800	4.9590	-0.058	0.09
10.283	4.963	35.0110	10.291	4.9576	-0.071	0.11
10.771	4.962	36.0122	10.778	4.9571	-0.071	0.10
11.256	4.962	37.0133	11.263	4.9568	-0.069	0.10
11.738	4.961	38.0142	11.746	4.9563	-0.069	0.09
12.220	4.960	39.0149	12.227	4.9562	-0.061	0.08
12.700	4.960	40.0154	12.706	4.9564	-0.049	0.07
13.656	4.958	42.0158	13.660	4.9561	-0.035	0.05
14.606	4.957	44.0155	14.610	4.9554	-0.027	0.03
15.554	4.956	46.0148	15.556	4.9549	-0.013	0.02
16.498	4.954	48.0142	16.499	4.9543	-0.002	0.00
17.443	4.953	50.0131	17.439	4.9543	0.020	-0.02
19.788	4.950	55.0071	19.780	4.9520	0.037	-0.04
22.120	4.947	59.9992	22.111	4.9492	0.044	-0.05
24.446	4.944	64.9999	24.436	4.9458	0.041	-0.04
26.760	4.941	70.0003	26.754	4.9417	0.024	-0.02

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
29.062	4.937	74.9944	29.060	4.9376	0.006	-0.01
31.360	4.934	79.9910	31.361	4.9340	-0.004	0.00
33.653	4.931	84.9971	33.659	4.9302	-0.017	0.02
35.941	4.928	90.0096	35.953	4.9262	-0.033	0.03
38.217	4.925	95.0121	38.235	4.9224	-0.046	0.05
40.483	4.921	100.0099	40.508	4.9184	-0.062	0.06
10.266	6.785	32.0084	10.266	6.7846	0.000	-0.00
10.989	6.784	33.0090	10.992	6.7796	-0.026	0.06
11.702	6.783	34.0099	11.710	6.7740	-0.063	0.13
12.411	6.782	35.0110	12.421	6.7710	-0.085	0.16
13.114	6.781	36.0122	13.128	6.7686	-0.102	0.18
13.814	6.780	37.0133	13.829	6.7676	-0.108	0.18
14.511	6.779	38.0142	14.527	6.7672	-0.109	0.17
15.206	6.778	39.0149	15.221	6.7680	-0.096	0.15
15.896	6.777	40.0154	15.912	6.7667	-0.104	0.15
17.271	6.775	42.0158	17.287	6.7663	-0.094	0.13
18.640	6.773	44.0155	18.654	6.7662	-0.079	0.10
20.003	6.771	46.0148	20.015	6.7662	-0.060	0.08
21.360	6.770	48.0142	21.371	6.7649	-0.055	0.07
22.714	6.768	50.0131	22.723	6.7645	-0.039	0.05
26.087	6.763	55.0071	26.087	6.7630	-0.002	0.00
29.435	6.759	59.9992	29.434	6.7590	0.005	-0.01
32.775	6.754	64.9999	32.772	6.7548	0.009	-0.01
36.097	6.750	70.0003	36.098	6.7496	-0.002	0.00
39.398	6.745	74.9944	39.406	6.7439	-0.020	0.02
42.694	6.741	79.9910	42.704	6.7393	-0.022	0.02
45.978	6.736	84.9971	45.996	6.7338	-0.038	0.04
49.262	6.732	90.0096	49.281	6.7293	-0.038	0.04
52.518	6.727	95.0121	52.547	6.7238	-0.054	0.05
55.759	6.723	100.0099	55.800	6.7183	-0.073	0.07
10.946	8.310	32.0084	10.951	8.2946	-0.045	0.19
11.878	8.309	33.0090	11.880	8.3045	-0.016	0.05
12.794	8.308	34.0099	12.798	8.2999	-0.035	0.09
13.699	8.306	35.0110	13.708	8.2941	-0.064	0.15
14.597	8.305	36.0122	14.611	8.2891	-0.094	0.19
15.489	8.304	37.0133	15.507	8.2857	-0.115	0.22
16.378	8.303	38.0142	16.398	8.2846	-0.123	0.22
17.261	8.302	39.0149	17.285	8.2830	-0.134	0.22
18.142	8.300	40.0154	18.167	8.2822	-0.138	0.22
19.894	8.298	42.0158	19.923	8.2806	-0.142	0.21
21.639	8.296	44.0155	21.668	8.2804	-0.133	0.18
23.377	8.293	46.0148	23.405	8.2802	-0.120	0.16
25.110	8.291	48.0142	25.136	8.2801	-0.104	0.13
26.839	8.289	50.0131	26.862	8.2799	-0.087	0.11
31.138	8.283	55.0071	31.155	8.2776	-0.056	0.06
35.414	8.277	59.9992	35.426	8.2741	-0.035	0.04
39.673	8.272	64.9999	39.685	8.2690	-0.030	0.03
43.911	8.266	70.0003	43.926	8.2630	-0.035	0.04
48.125	8.260	74.9944	48.144	8.2571	-0.040	0.04
52.326	8.255	79.9910	52.347	8.2514	-0.041	0.04

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
56.514	8.249	84.9971	56.541	8.2454	-0.048	0.05
60.691	8.244	90.0096	60.724	8.2392	-0.055	0.05
64.846	8.238	95.0121	64.882	8.2336	-0.056	0.05
68.980	8.232	100.0099	69.019	8.2278	-0.057	0.05
12.473	10.145	33.0090	12.466	10.1814	0.059	-0.36
13.644	10.144	34.0099	13.633	10.1777	0.085	-0.34
14.797	10.142	35.0110	14.790	10.1574	0.049	-0.15
15.942	10.141	36.0122	15.940	10.1434	0.011	-0.03
17.078	10.139	37.0133	17.083	10.1322	-0.031	0.07
18.209	10.138	38.0142	18.220	10.1256	-0.059	0.12
19.337	10.136	39.0149	19.352	10.1212	-0.079	0.15
20.465	10.135	40.0154	20.480	10.1218	-0.072	0.13
22.699	10.132	42.0158	22.725	10.1136	-0.114	0.18
24.929	10.129	44.0155	24.959	10.1109	-0.122	0.17
27.151	10.126	46.0148	27.185	10.1090	-0.122	0.16
29.369	10.123	48.0142	29.403	10.1075	-0.117	0.15
31.581	10.120	50.0131	31.616	10.1061	-0.110	0.13
37.090	10.112	55.0071	37.121	10.1028	-0.084	0.09
42.570	10.105	59.9992	42.598	10.0980	-0.065	0.07
48.028	10.098	64.9999	48.059	10.0912	-0.065	0.07
53.458	10.091	70.0003	53.495	10.0839	-0.069	0.07
58.856	10.084	74.9944	58.899	10.0766	-0.073	0.07
64.238	10.077	79.9910	64.282	10.0700	-0.069	0.07
69.609	10.070	84.9971	69.650	10.0640	-0.059	0.06
74.951	10.063	90.0096	75.001	10.0563	-0.067	0.06
80.263	10.055	95.0121	80.318	10.0492	-0.068	0.06
85.547	10.048	100.0099	85.606	10.0421	-0.069	0.06
12.709	11.818	33.0090	12.695	12.0093	0.114	-1.62
14.114	11.816	34.0099	14.097	11.9442	0.192	-1.09
15.497	11.814	35.0110	15.473	11.8816	0.153	-0.57
16.870	11.812	36.0122	16.853	11.8464	0.100	-0.29
18.239	11.810	37.0133	18.229	11.8258	0.054	-0.13
19.603	11.808	38.0142	19.600	11.8124	0.016	-0.03
20.963	11.807	39.0149	20.967	11.8025	-0.018	0.03
22.322	11.805	40.0154	22.331	11.7962	-0.040	0.07
25.035	11.801	42.0158	25.052	11.7884	-0.068	0.11
27.737	11.797	44.0155	27.763	11.7818	-0.093	0.13
30.436	11.794	46.0148	30.467	11.7779	-0.102	0.13
33.129	11.790	48.0142	33.165	11.7742	-0.109	0.14
35.820	11.787	50.0131	35.858	11.7718	-0.106	0.13
42.520	11.778	55.0071	42.563	11.7650	-0.100	0.11
49.190	11.769	59.9992	49.234	11.7584	-0.089	0.09
55.841	11.761	64.9999	55.886	11.7512	-0.080	0.08
62.457	11.752	70.0003	62.505	11.7433	-0.077	0.07
69.030	11.743	74.9944	69.083	11.7350	-0.077	0.07
75.580	11.735	79.9910	75.632	11.7277	-0.068	0.06
82.108	11.726	84.9971	82.159	11.7199	-0.062	0.06
88.610	11.718	90.0096	88.663	11.7118	-0.060	0.05
95.070	11.710	95.0121	95.123	11.7039	-0.056	0.05
101.491	11.701	100.0099	101.545	11.6958	-0.054	0.05

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
118.392	14.994	90.0096	118.430	14.9904	-0.032	0.03
127.405	14.983	95.0121	127.422	14.9814	-0.014	0.01
136.361	14.972	100.0099	136.356	14.9724	0.004	-0.00
12.804	15.524	33.0090	12.803	15.5786	0.004	-0.35
14.683	15.521	34.0099	14.693	15.4578	-0.065	0.41
16.583	15.519	35.0110	16.596	15.4742	-0.080	0.29
18.498	15.516	36.0122	18.510	15.4903	-0.063	0.17
20.422	15.514	37.0133	20.432	15.4969	-0.050	0.11
22.353	15.511	38.0142	22.362	15.4995	-0.039	0.07
24.289	15.508	39.0149	24.297	15.4998	-0.033	0.06
26.228	15.506	40.0154	26.236	15.4983	-0.032	0.05
12.807	16.398	33.0090	12.813	15.8799	-0.045	3.16
14.799	16.395	34.0099	14.828	16.2127	-0.196	1.11
16.832	16.392	35.0110	16.863	16.2925	-0.187	0.61
18.886	16.389	36.0122	18.915	16.3278	-0.156	0.38
20.955	16.387	37.0133	20.980	16.3476	-0.120	0.24
23.035	16.384	38.0142	23.056	16.3583	-0.090	0.16
25.123	16.381	39.0149	25.140	16.3637	-0.068	0.11
27.216	16.378	40.0154	27.231	16.3654	-0.055	0.08
14.798	16.395	34.0099	14.828	16.2093	-0.200	1.13
16.833	16.392	35.0110	16.863	16.2963	-0.180	0.59
18.891	16.390	36.0122	18.915	16.3383	-0.130	0.31
20.962	16.387	37.0133	20.980	16.3587	-0.087	0.17
23.043	16.384	38.0142	23.056	16.3679	-0.057	0.10
25.132	16.381	39.0149	25.140	16.3737	-0.030	0.05
27.227	16.378	40.0154	27.231	16.3746	-0.016	0.02
31.430	16.373	42.0158	31.429	16.3734	0.003	-0.00
35.648	16.367	44.0155	35.641	16.3710	0.020	-0.02
39.835	16.362	46.0148	39.862	16.3501	-0.067	0.07
44.054	16.356	48.0142	44.086	16.3444	-0.072	0.07
48.269	16.351	50.0131	48.310	16.3375	-0.084	0.08
58.797	16.337	55.0071	58.847	16.3247	-0.085	0.08
69.274	16.324	59.9992	69.339	16.3107	-0.094	0.08
79.725	16.311	64.9999	79.794	16.2991	-0.086	0.07
90.114	16.298	70.0003	90.184	16.2876	-0.078	0.06
100.433	16.285	74.9944	100.495	16.2769	-0.062	0.05
110.701	16.272	79.9910	110.745	16.2672	-0.040	0.03
120.913	16.260	84.9971	120.948	16.2561	-0.029	0.02
131.078	16.247	90.0096	131.098	16.2453	-0.016	0.01
141.168	16.235	95.0121	141.166	16.2352	0.002	-0.00
151.191	16.223	100.0099	151.161	16.2251	0.020	-0.02
12.841	18.116	33.0090	12.855	17.7486	-0.113	2.03
15.098	18.113	34.0099	15.147	17.8821	-0.329	1.27
17.432	18.110	35.0110	17.472	18.0088	-0.232	0.56
19.792	18.107	36.0122	19.824	18.0523	-0.162	0.30
22.175	18.103	37.0133	22.197	18.0753	-0.100	0.16
24.583	18.100	38.0142	24.588	18.0943	-0.024	0.03
26.990	18.097	39.0149	26.994	18.0936	-0.015	0.02
29.413	18.094	40.0154	29.411	18.0952	0.007	-0.01
34.280	18.087	42.0158	34.270	18.0928	0.028	-0.03

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
12.794	14.099	33.0090	12.787	14.6404	0.058	-3.84
14.497	14.096	34.0099	14.482	14.1942	0.101	-0.69
16.194	14.094	35.0110	16.182	14.1367	0.076	-0.30
17.892	14.092	36.0122	17.884	14.1111	0.047	-0.14
19.593	14.089	37.0133	19.588	14.0983	0.026	-0.06
21.294	14.087	38.0142	21.294	14.0876	0.002	-0.00
22.997	14.085	39.0149	23.001	14.0803	-0.017	0.03
24.699	14.083	40.0154	24.708	14.0741	-0.036	0.06
14.502	14.131	34.0099	14.488	14.2248	0.096	-0.66
16.202	14.129	35.0110	16.192	14.1655	0.065	-0.26
17.908	14.126	36.0122	17.899	14.1468	0.049	-0.14
19.614	14.124	37.0133	19.608	14.1338	0.029	-0.07
21.321	14.122	38.0142	21.319	14.1239	0.007	-0.01
23.029	14.120	39.0149	23.032	14.1171	-0.010	0.02
24.740	14.117	40.0154	24.745	14.1128	-0.019	0.03
28.158	14.113	42.0158	28.173	14.1023	-0.051	0.07
31.578	14.108	44.0155	31.601	14.0947	-0.073	0.10
35.000	14.104	46.0148	35.028	14.0900	-0.080	0.10
38.421	14.099	48.0142	38.454	14.0851	-0.087	0.10
41.837	14.095	50.0131	41.876	14.0803	-0.093	0.10
50.362	14.084	55.0071	50.407	14.0706	-0.091	0.09
58.850	14.073	59.9992	58.901	14.0608	-0.088	0.08
67.315	14.062	64.9999	67.369	14.0516	-0.080	0.07
75.730	14.051	70.0003	75.791	14.0411	-0.081	0.07
84.096	14.041	74.9944	84.155	14.0320	-0.070	0.06
92.423	14.030	79.9910	92.476	14.0232	-0.057	0.05
100.714	14.020	84.9971	100.766	14.0135	-0.052	0.04
108.972	14.009	90.0096	109.019	14.0041	-0.044	0.04
117.166	13.999	95.0121	117.210	13.9945	-0.037	0.03
125.316	13.988	100.0099	125.348	13.9856	-0.025	0.02
12.801	15.130	33.0090	12.800	15.2834	0.012	-1.01
14.630	15.127	34.0099	14.635	15.0987	-0.029	0.19
16.477	15.125	35.0110	16.480	15.1145	-0.019	0.07
18.332	15.122	36.0122	18.334	15.1181	-0.011	0.03
20.192	15.120	37.0133	20.194	15.1158	-0.012	0.03
22.061	15.117	38.0142	22.061	15.1183	0.003	-0.01
23.930	15.115	39.0149	23.931	15.1143	-0.002	0.00
25.800	15.112	40.0154	25.805	15.1076	-0.020	0.03
29.549	15.107	42.0158	29.560	15.1001	-0.036	0.05
33.305	15.102	44.0155	33.321	15.0933	-0.049	0.06
37.060	15.098	46.0148	37.085	15.0856	-0.068	0.08
40.816	15.093	48.0142	40.851	15.0785	-0.086	0.09
44.576	15.088	50.0131	44.614	15.0746	-0.084	0.09
53.945	15.076	55.0071	53.998	15.0612	-0.099	0.10
63.286	15.064	59.9992	63.343	15.0511	-0.091	0.08
72.593	15.052	64.9999	72.658	15.0400	-0.089	0.08
81.854	15.040	70.0003	81.919	15.0299	-0.080	0.07
91.053	15.029	74.9944	91.115	15.0201	-0.067	0.06
100.208	15.017	79.9910	100.259	15.0107	-0.052	0.04
109.316	15.006	84.9971	109.336	15.0001	-0.045	0.04

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
39.153	18.081	44.0155	39.153	18.0812	0.001	-0.00
44.039	18.075	46.0148	44.049	18.0708	-0.023	0.02
48.928	18.068	48.0142	48.953	18.0600	-0.052	0.05
53.820	18.062	50.0131	53.857	18.0513	-0.068	0.06
66.031	18.046	55.0071	66.089	18.0335	-0.088	0.07
78.193	18.031	59.9992	78.263	18.0186	-0.089	0.07
90.304	18.016	64.9999	90.384	18.0041	-0.088	0.07
102.345	18.001	70.0003	102.420	17.9915	-0.074	0.06
114.296	17.987	74.9944	114.355	17.9799	-0.052	0.04
126.175	17.972	79.9910	126.211	17.9687	-0.029	0.02
137.978	17.958	84.9971	138.005	17.9558	-0.020	0.01
149.739	17.944	90.0096	149.731	17.9449	0.005	-0.00
161.397	17.930	95.0121	161.356	17.9337	0.026	-0.02
172.960	17.917	100.0099	172.891	17.9217	0.040	-0.03
12.999	19.804	33.0090	13.015	19.7000	-0.126	0.52
15.605	19.800	34.0099	15.635	19.7192	-0.193	0.41
18.284	19.796	35.0110	18.297	19.7734	-0.075	0.12
21.002	19.793	36.0122	20.935	19.8015	0.035	-0.04
23.749	19.789	37.0133	23.721	19.8160	0.119	-0.14
26.514	19.785	38.0142	26.469	19.8199	0.166	-0.17
29.283	19.782	39.0149	29.236	19.8130	0.162	-0.16
32.064	19.778	40.0154	32.017	19.8050	0.147	-0.14
37.661	19.771	42.0158	37.611	19.7931	0.132	-0.11
43.268	19.763	44.0155	43.233	19.7765	0.081	-0.07
48.887	19.756	46.0148	48.870	19.7614	0.035	-0.03
54.512	19.749	48.0142	54.514	19.7482	-0.003	0.00
60.131	19.742	50.0131	60.156	19.7354	-0.042	0.03
74.156	19.724	55.0071	74.221	19.7117	-0.087	0.06
88.108	19.707	59.9992	88.200	19.6923	-0.104	0.07
101.998	19.690	64.9999	102.102	19.6758	-0.102	0.07
115.808	19.673	70.0003	115.835	19.6632	-0.075	0.05
129.495	19.657	74.9944	129.559	19.6503	-0.049	0.03
143.069	19.641	79.9910	143.120	19.6360	-0.036	0.02
156.597	19.625	84.9971	156.601	19.6244	-0.003	0.00
170.024	19.609	90.0096	169.999	19.6111	0.014	-0.01
183.348	19.594	95.0121	183.274	19.5993	0.040	-0.03
196.571	19.578	100.0099	196.436	19.5874	0.069	-0.05
13.216	20.705	33.0090	13.217	20.7013	-0.008	0.02
16.041	20.701	34.0099	16.041	20.7012	0.001	-0.00
18.932	20.697	35.0110	18.911	20.7248	0.113	-0.13
21.862	20.693	36.0122	21.819	20.7354	0.197	-0.20
24.820	20.689	37.0133	24.757	20.7393	0.256	-0.24
27.794	20.685	38.0142	27.719	20.7349	0.271	-0.24
30.782	20.681	39.0149	30.700	20.7277	0.266	-0.22
33.781	20.677	40.0154	33.697	20.7194	0.250	-0.20
39.802	20.670	42.0158	39.723	20.7012	0.199	-0.15
45.837	20.662	44.0155	45.776	20.6822	0.135	-0.10
51.876	20.654	46.0148	51.843	20.6633	0.063	-0.04
57.920	20.646	48.0142	57.915	20.6474	0.008	-0.01
63.961	20.639	50.0131	63.932	20.6338	-0.033	0.02

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
79.026	20.620	55.0071	79.096	20.6073	-0.089	0.06
94.015	20.601	59.9992	94.106	20.5880	-0.097	0.06
108.922	20.583	64.9999	109.023	20.5708	-0.093	0.06
123.721	20.566	70.0003	123.812	20.5558	-0.074	0.05
138.375	20.548	74.9944	138.457	20.5405	-0.059	0.04
152.940	20.531	79.9910	152.984	20.5275	-0.029	0.02
167.419	20.515	84.9971	167.421	20.5143	-0.002	0.00
181.791	20.498	90.0096	181.762	20.5000	0.016	-0.01
196.038	20.482	95.0121	195.965	20.4865	0.037	-0.02
210.149	20.465	100.0099	210.051	20.4715	0.046	-0.03
13.595	21.622	33.0090	13.570	21.6722	0.183	-0.23
16.665	21.618	34.0099	16.624	21.6720	0.247	-0.25
19.794	21.614	35.0110	19.727	21.6792	0.341	-0.30
22.961	21.610	36.0122	22.869	21.6808	0.403	-0.33
26.153	21.605	37.0133	26.041	21.6766	0.427	-0.33
29.359	21.601	38.0142	29.238	21.6668	0.411	-0.30
32.582	21.597	39.0149	32.455	21.6572	0.389	-0.28
35.810	21.593	40.0154	35.686	21.6449	0.346	-0.24
42.290	21.584	42.0158	42.181	21.6219	0.258	-0.17
48.779	21.576	44.0155	48.700	21.5986	0.160	-0.11
55.273	21.568	46.0148	55.231	21.5782	0.076	-0.05
61.770	21.559	48.0142	61.762	21.5610	0.013	-0.01
68.258	21.551	50.0131	68.286	21.5457	-0.040	0.03
84.439	21.531	55.0071	84.520	21.5180	-0.095	0.06
100.505	21.511	59.9992	100.627	21.4949	-0.122	0.08
116.494	21.492	64.9999	116.622	21.4776	-0.110	0.07
132.353	21.474	70.0003	132.469	21.4618	-0.088	0.05
148.062	21.455	74.9944	148.152	21.4471	-0.061	0.04
163.658	21.437	79.9910	163.706	21.4334	-0.029	0.02
179.153	21.420	84.9971	179.157	21.4194	-0.002	0.00
194.540	21.402	90.0096	194.497	21.4051	0.022	-0.01
209.772	21.385	95.0121	209.690	21.3903	0.039	-0.02
224.862	21.368	100.0099	224.752	21.3746	0.049	-0.03
14.346	22.722	33.0090	14.237	22.7915	0.412	-0.31
17.741	22.717	34.0099	17.649	22.7973	0.518	-0.35
21.185	22.713	35.0110	21.059	22.7996	0.593	-0.38
24.663	22.708	36.0122	24.508	22.7970	0.628	-0.39
28.154	22.703	37.0133	27.987	22.7857	0.594	-0.36
31.658	22.699	38.0142	31.490	22.7712	0.531	-0.32
35.175	22.694	39.0149	35.010	22.7573	0.468	-0.28
38.701	22.690	40.0154	38.545	22.7437	0.404	-0.24
45.770	22.680	42.0158	45.641	22.7179	0.283	-0.17
52.837	22.671	44.0155	52.756	22.6916	0.153	-0.09
59.911	22.662	46.0148	59.875	22.6704	0.061	-0.04
66.981	22.654	48.0142	66.989	22.6519	-0.012	0.01
74.039	22.645	50.0131	74.089	22.6359	-0.067	0.04
91.632	22.623	55.0071	91.738	22.6079	-0.115	0.07
109.074	22.602	59.9992	109.226	22.5838	-0.139	0.08
126.409	22.582	64.9999	126.574	22.5644	-0.130	0.08
143.603	22.562	70.0003	143.749	22.5483	-0.102	0.06

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
227.963	24.641	84.9971	228.069	24.6350	-0.046	0.02
247.262	24.620	90.0096	247.311	24.6177	-0.020	0.01
266.278	24.600	95.0121	266.359	24.5964	-0.030	0.02
285.168	24.580	100.0099	285.218	24.5778	-0.017	0.01
10.210	25.552	31.0080	10.185	25.5663	0.243	-0.06
14.476	25.546	32.0084	14.373	25.5955	0.712	-0.19
18.783	25.540	33.0090	18.622	25.6058	0.860	-0.26
23.122	25.534	34.0099	22.919	25.6060	0.877	-0.28
27.483	25.528	35.0110	27.254	25.6005	0.836	-0.28
31.848	25.523	36.0122	31.617	25.5879	0.725	-0.26
36.221	25.517	37.0133	36.000	25.5737	0.609	-0.22
40.599	25.511	38.0142	40.397	25.5590	0.497	-0.19
44.974	25.506	39.0149	44.804	25.5430	0.380	-0.15
49.356	25.500	40.0154	49.215	25.5288	0.286	-0.11
58.116	25.489	42.0158	58.040	25.5027	0.131	-0.05
66.848	25.478	44.0155	66.854	25.4771	-0.009	0.00
75.566	25.467	46.0148	75.645	25.4556	-0.104	0.05
84.267	25.456	48.0142	84.405	25.4379	-0.164	0.07
92.929	25.446	50.0131	93.128	25.4212	-0.214	0.10
114.456	25.420	55.0071	114.746	25.3900	-0.254	0.12
135.767	25.395	59.9992	136.091	25.3662	-0.239	0.12
156.903	25.372	64.9999	157.218	25.3467	-0.201	0.10
177.808	25.348	70.0003	178.091	25.3282	-0.159	0.08
198.459	25.326	74.9944	198.707	25.3097	-0.125	0.06
218.934	25.304	79.9910	219.115	25.2927	-0.083	0.04
239.206	25.282	84.9971	239.372	25.2732	-0.070	0.04
259.343	25.261	90.0096	259.460	25.2551	-0.045	0.02
279.231	25.240	95.0121	279.335	25.2353	-0.037	0.02
298.903	25.220	100.0099	299.021	25.2143	-0.039	0.02
11.524	26.225	31.0080	11.485	26.2430	0.336	-0.07
16.044	26.219	32.0084	15.935	26.2610	0.679	-0.16
20.594	26.213	33.0090	20.440	26.2643	0.747	-0.19
25.170	26.207	34.0099	24.989	26.2607	0.723	-0.20
29.765	26.201	35.0110	29.570	26.2529	0.656	-0.20
34.370	26.195	36.0122	34.175	26.2421	0.566	-0.18
38.981	26.189	37.0133	38.797	26.2299	0.471	-0.16
43.589	26.183	38.0142	43.429	26.2159	0.366	-0.13
48.197	26.177	39.0149	48.068	26.2021	0.268	-0.10
52.805	26.171	40.0154	52.708	26.1889	0.184	-0.07
62.000	26.160	42.0158	61.981	26.1627	0.031	-0.01
71.169	26.148	44.0155	71.236	26.1386	-0.094	0.04
80.330	26.137	46.0148	80.457	26.1201	-0.158	0.06
89.445	26.126	48.0142	89.642	26.1018	-0.219	0.09
98.529	26.115	50.0131	98.782	26.0862	-0.257	0.11
121.075	26.088	55.0071	121.417	26.0553	-0.282	0.13
143.396	26.063	59.9992	143.751	26.0327	-0.248	0.11
165.485	26.038	64.9999	165.841	26.0112	-0.215	0.10
187.342	26.014	70.0003	187.664	25.9922	-0.172	0.08
208.921	25.990	74.9944	209.207	25.9729	-0.137	0.07
230.298	25.968	79.9910	230.533	25.9543	-0.102	0.05

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
160.617	22.542	74.9944	160.737	22.5323	-0.075	0.04
177.512	22.523	79.9910	177.570	22.5185	-0.033	0.02
194.271	22.504	84.9971	194.288	22.5029	-0.009	0.01
210.905	22.485	90.0096	210.882	22.4869	0.011	-0.01
227.380	22.467	95.0121	227.310	22.4715	0.031	-0.02
243.695	22.449	100.0099	243.593	22.4549	0.042	-0.03
11.875	23.831	32.0084	11.821	23.8845	0.458	-0.23
15.564	23.826	33.0090	15.467	23.8978	0.623	-0.30
19.309	23.821	34.0099	19.171	23.9033	0.716	-0.35
23.091	23.816	35.0110	22.921	23.9009	0.738	-0.36
26.897	23.811	36.0122	26.707	23.8925	0.706	-0.34
30.716	23.806	37.0133	30.520	23.8799	0.637	-0.31
34.549	23.800	38.0142	34.355	23.8665	0.563	-0.28
38.390	23.796	39.0149	38.205	23.8522	0.480	-0.24
42.236	23.791	40.0154	42.066	23.8381	0.401	-0.20
49.930	23.781	42.0158	49.809	23.8098	0.242	-0.12
57.631	23.771	44.0155	57.560	23.7858	0.123	-0.06
65.318	23.761	46.0148	65.307	23.7631	0.016	-0.01
72.996	23.752	48.0142	73.041	23.7440	-0.061	0.03
80.666	23.742	50.0131	80.751	23.7288	-0.106	0.06
99.733	23.719	55.0071	99.898	23.6980	-0.165	0.09
118.642	23.696	59.9992	118.842	23.6748	-0.168	0.09
137.417	23.675	64.9999	137.617	23.6558	-0.145	0.08
155.999	23.654	70.0003	156.192	23.6375	-0.123	0.07
174.400	23.633	74.9944	174.547	23.6215	-0.085	0.05
192.631	23.612	79.9910	192.733	23.6053	-0.053	0.03
210.738	23.593	84.9971	210.730	23.5895	-0.025	0.01
228.692	23.573	90.0096	228.701	23.5724	-0.004	0.00
246.449	23.554	95.0121	246.431	23.5547	0.007	-0.00
264.040	23.535	100.0099	264.002	23.5367	0.015	-0.01
13.272	24.895	32.0084	13.189	24.9470	0.629	-0.21
17.345	24.890	33.0090	17.200	24.9628	0.834	-0.29
21.451	24.884	34.0099	21.264	24.9643	0.871	-0.32
25.585	24.879	35.0110	25.369	24.9593	0.845	-0.32
29.726	24.873	36.0122	29.507	24.9459	0.738	-0.29
33.895	24.868	37.0133	33.667	24.9357	0.672	-0.27
38.064	24.862	38.0142	37.844	24.9218	0.577	-0.24
42.232	24.857	39.0149	42.033	24.9065	0.472	-0.20
46.402	24.852	40.0154	46.230	24.8911	0.369	-0.16
54.745	24.841	42.0158	54.635	24.8634	0.202	-0.09
63.089	24.831	44.0155	63.035	24.8402	0.086	-0.04
71.393	24.820	46.0148	71.420	24.8158	-0.037	0.02
79.692	24.810	48.0142	79.792	24.7966	-0.114	0.05
87.939	24.800	50.0131	88.114	24.7764	-0.198	0.09
108.542	24.775	55.0071	108.773	24.7492	-0.212	0.10
128.920	24.751	59.9992	129.184	24.7252	-0.205	0.10
149.132	24.728	64.9999	149.401	24.7052	-0.180	0.09
169.131	24.705	70.0003	169.380	24.6863	-0.147	0.08
188.926	24.684	74.9944	189.124	24.6700	-0.104	0.06
208.507	24.662	79.9910	208.656	24.6517	-0.076	0.04

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
251.477	25.946	84.9971	251.699	25.9342	-0.088	0.04
272.480	25.924	90.0096	272.683	25.9140	-0.075	0.04
293.213	25.902	95.0121	293.443	25.8920	-0.079	0.04
313.736	25.881	100.0099	314.006	25.8696	-0.086	0.05
8.628	26.963	30.0076	8.649	26.9547	-0.249	0.03
13.404	26.957	31.0080	13.333	26.9816	0.527	-0.09
18.222	26.951	32.0084	18.079	26.9938	0.784	-0.16
23.056	26.944	33.0090	22.873	26.9934	0.795	-0.18
27.908	26.938	34.0099	27.704	26.9873	0.732	-0.18
32.765	26.931	35.0110	32.562	26.9764	0.620	-0.17
37.630	26.925	36.0122	37.439	26.9642	0.508	-0.15
42.499	26.919	37.0133	42.328	26.9513	0.402	-0.12
47.362	26.912	38.0142	47.223	26.9372	0.293	-0.09
52.222	26.906	39.0149	52.120	26.9233	0.195	-0.06
57.076	26.900	40.0154	57.016	26.9096	0.106	-0.04
66.763	26.888	42.0158	66.792	26.8838	-0.044	0.02
76.419	26.876	44.0155	76.536	26.8608	-0.153	0.06
86.038	26.864	46.0148	86.239	26.8402	-0.233	0.09
95.622	26.853	48.0142	95.895	26.8224	-0.285	0.11
105.176	26.841	50.0131	105.500	26.8077	-0.308	0.12
128.858	26.813	55.0071	129.268	26.7771	-0.318	0.14
152.275	26.787	59.9992	152.704	26.7535	-0.281	0.12
175.469	26.761	64.9999	175.870	26.7333	-0.228	0.10
198.386	26.736	70.0003	198.750	26.7135	-0.183	0.09
221.003	26.713	74.9944	221.339	26.6933	-0.152	0.07
243.406	26.689	79.9910	243.684	26.6740	-0.114	0.06
265.594	26.666	84.9971	265.855	26.6530	-0.098	0.05
287.572	26.644	90.0096	287.847	26.6309	-0.096	0.05
309.280	26.621	95.0121	309.534	26.6078	-0.101	0.05
330.750	26.600	100.0099	331.141	26.5838	-0.118	0.06
10.564	27.643	30.0076	10.544	27.6492	0.183	-0.02
15.630	27.636	31.0080	15.521	27.6667	0.701	-0.11
20.728	27.630	32.0084	20.550	27.6736	0.857	-0.16
25.829	27.623	33.0090	25.620	27.6695	0.807	-0.17
30.940	27.616	34.0099	30.721	27.6611	0.709	-0.16
36.055	27.609	35.0110	35.844	27.6495	0.587	-0.15
41.170	27.603	36.0122	40.980	27.6363	0.461	-0.12
46.279	27.596	37.0133	46.124	27.6219	0.335	-0.09
51.383	27.590	38.0142	51.270	27.6073	0.221	-0.06
56.478	27.583	39.0149	56.414	27.5926	0.114	-0.03
61.570	27.577	40.0154	61.553	27.5792	0.028	-0.01
71.715	27.564	42.0158	71.806	27.5524	-0.128	0.04
81.818	27.552	44.0155	82.016	27.5284	-0.242	0.08
91.889	27.540	46.0148	92.176	27.5083	-0.312	0.11
101.916	27.527	48.0142	102.282	27.4905	-0.359	0.13
111.909	27.516	50.0131	112.329	27.4759	-0.375	0.14
136.662	27.487	55.0071	137.174	27.4449	-0.375	0.15
161.135	27.460	59.9992	161.658	27.4215	-0.324	0.14
185.348	27.433	64.9999	185.854	27.4002	-0.273	0.12
209.268	27.408	70.0003	209.741	27.3797	-0.226	0.10

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
232.871	27.383	74.9944	233.318	27.3587	-0.192	0.09
256.235	27.358	79.9910	256.636	27.3381	-0.157	0.07
279.383	27.335	84.9971	279.785	27.3165	-0.144	0.07
302.286	27.312	90.0096	302.730	27.2926	-0.147	0.07
324.948	27.290	95.0121	325.429	27.2698	-0.148	0.07
8.051	28.458	29.0073	8.195	28.4184	-1.794	0.14
13.426	28.451	30.0076	13.470	28.4402	-0.330	0.04
18.812	28.444	31.0080	18.803	28.4457	0.047	-0.01
24.239	28.437	32.0084	24.179	28.4486	0.248	-0.04
29.649	28.427	33.0090	29.571	28.4409	0.263	-0.05
35.069	28.422	34.0099	35.015	28.4314	0.153	-0.03
40.490	28.415	35.0110	40.460	28.4200	0.075	-0.02
45.910	28.408	36.0122	45.912	28.4080	-0.003	0.00
51.314	28.401	37.0133	51.366	28.3941	-0.100	0.03
56.712	28.395	38.0142	56.816	28.3806	-0.182	0.05
62.099	28.388	39.0149	62.258	28.3672	-0.256	0.07
67.480	28.381	40.0154	67.694	28.3549	-0.317	0.09
78.209	28.368	42.0158	78.528	28.3321	-0.407	0.13
88.893	28.355	44.0155	89.305	28.3121	-0.464	0.15
99.520	28.342	46.0148	100.019	28.2938	-0.501	0.17
110.097	28.330	48.0142	110.670	28.2775	-0.520	0.18
120.628	28.318	50.0131	121.259	28.2637	-0.523	0.19
146.709	28.288	55.0071	147.415	28.2350	-0.481	0.19
172.441	28.259	59.9992	173.169	28.2103	-0.422	0.17
197.902	28.231	64.9999	198.613	28.1886	-0.359	0.15
223.023	28.205	70.0003	223.734	28.1662	-0.319	0.14
247.840	28.179	74.9944	248.503	28.1453	-0.268	0.12
272.351	28.155	79.9910	273.041	28.1222	-0.253	0.12
296.625	28.130	84.9971	297.363	28.0980	-0.249	0.11
320.697	28.107	90.0096	321.493	28.0742	-0.248	0.12
344.394	28.083	95.0121	345.337	28.0466	-0.274	0.13
6.096	29.314	28.0071	6.173	29.2963	-1.266	0.06
11.854	29.306	29.0073	11.783	29.3211	0.605	-0.05
17.617	29.299	30.0076	17.452	29.3295	0.936	-0.11
23.372	29.291	31.0080	23.167	29.3265	0.879	-0.12
29.138	29.283	32.0084	28.912	29.3197	0.777	-0.12
34.899	29.276	33.0090	34.679	29.3088	0.631	-0.11
40.653	29.268	34.0099	40.460	29.2956	0.476	-0.09
46.400	29.261	35.0110	46.248	29.2811	0.326	-0.07
52.149	29.254	36.0122	52.038	29.2678	0.213	-0.05
57.874	29.246	37.0133	57.823	29.2526	0.087	-0.02
63.600	29.239	38.0142	63.597	29.2394	0.004	-0.00
69.307	29.232	39.0149	69.361	29.2260	-0.079	0.02
74.991	29.225	40.0154	75.113	29.2122	-0.163	0.04
86.331	29.211	42.0158	86.567	29.1882	-0.273	0.08
97.610	29.198	44.0155	97.948	29.1666	-0.346	0.11
108.831	29.185	46.0148	109.259	29.1476	-0.393	0.13
120.008	29.172	48.0142	120.497	29.1319	-0.407	0.14
131.123	29.159	50.0131	131.661	29.1177	-0.410	0.14
158.655	29.127	55.0071	159.219	29.0892	-0.355	0.13

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
185.821	29.098	59.9992	186.353	29.0655	-0.286	0.11
212.670	29.069	64.9999	213.144	29.0431	-0.223	0.09
239.174	29.042	70.0003	239.594	29.0210	-0.176	0.07
265.294	29.016	74.9944	265.691	28.9974	-0.150	0.06
291.120	28.990	79.9910	291.510	28.9733	-0.134	0.06
316.681	28.965	84.9971	317.110	28.9475	-0.136	0.06
341.943	28.941	90.0096	342.513	28.9190	-0.167	0.08
10.553	30.178	28.0071	10.514	30.1848	0.366	-0.02
16.676	30.170	29.0073	16.544	30.1911	0.793	-0.07
22.802	30.162	30.0076	22.618	30.1891	0.807	-0.09
28.917	30.154	31.0080	28.724	30.1806	0.667	-0.09
35.025	30.146	32.0084	34.849	30.1689	0.503	-0.08
41.134	30.138	33.0090	40.986	30.1562	0.359	-0.06
47.229	30.130	34.0099	47.129	30.1418	0.212	-0.04
53.324	30.122	35.0110	53.271	30.1282	0.099	-0.02
59.402	30.115	36.0122	59.409	30.1140	-0.010	0.00
65.463	30.107	37.0133	65.535	30.0997	-0.110	0.02
71.518	30.099	38.0142	71.645	30.0869	-0.178	0.04
77.545	30.092	39.0149	77.740	30.0734	-0.252	0.06
83.573	30.085	40.0154	83.818	30.0622	-0.293	0.08
95.571	30.071	42.0158	95.914	30.0410	-0.359	0.10
107.495	30.056	44.0155	107.920	30.0217	-0.395	0.11
119.346	30.042	46.0148	119.848	30.0040	-0.420	0.13
131.139	30.029	48.0142	131.693	29.9889	-0.422	0.13
142.862	30.016	50.0131	143.454	29.9750	-0.415	0.14
171.896	29.983	55.0071	172.480	29.9474	-0.340	0.12
200.511	29.953	59.9992	201.051	29.9229	-0.269	0.10
228.784	29.923	64.9999	229.254	29.8995	-0.206	0.08
256.676	29.895	70.0003	257.095	29.8758	-0.163	0.07
284.157	29.868	74.9944	284.566	29.8504	-0.144	0.06
311.342	29.842	79.9910	311.751	29.8253	-0.131	0.06
338.184	29.816	84.9971	338.709	29.7961	-0.155	0.07
10.446	31.141	27.0071	10.369	31.1522	0.742	-0.04
17.005	31.132	28.0071	16.815	31.1575	1.118	-0.08
23.542	31.124	29.0073	23.305	31.1532	1.007	-0.09
30.056	31.115	30.0076	29.825	31.1425	0.770	-0.09
36.565	31.107	31.0080	36.362	31.1295	0.556	-0.07
43.062	31.098	32.0084	42.906	31.1151	0.361	-0.05
49.542	31.090	33.0090	49.452	31.0993	0.181	-0.03
55.999	31.082	34.0099	55.994	31.0824	0.009	-0.00
62.469	31.074	35.0110	62.527	31.0682	-0.094	0.02
68.921	31.066	36.0122	69.051	31.0541	-0.189	0.04
75.361	31.058	37.0133	75.557	31.0410	-0.261	0.06
81.768	31.050	38.0142	82.037	31.0272	-0.329	0.07
88.164	31.042	39.0149	88.500	31.0147	-0.381	0.09
94.554	31.035	40.0154	94.941	31.0039	-0.410	0.10
107.271	31.020	42.0158	107.756	30.9837	-0.452	0.12
119.910	31.005	44.0155	120.463	30.9657	-0.461	0.13
132.469	30.990	46.0148	133.075	30.9495	-0.457	0.13
144.966	30.976	48.0142	145.536	30.9356	-0.435	0.13

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
157.384	30.963	50.0131	158.035	30.9228	-0.414	0.13
188.112	30.930	55.0071	188.724	30.8957	-0.326	0.11
218.355	30.898	59.9992	218.910	30.8696	-0.254	0.09
248.202	30.867	64.9999	248.719	30.8433	-0.208	0.08
277.642	30.838	70.0003	278.145	30.8167	-0.181	0.07
306.644	30.811	74.9944	307.131	30.7886	-0.179	0.07
335.370	30.783	79.9910	335.936	30.7623	-0.169	0.07
4.544	32.146	25.0078	4.587	32.1412	-0.942	0.02
11.525	32.137	26.0073	11.420	32.1491	0.919	-0.04
18.484	32.128	27.0071	18.309	32.1466	0.947	-0.06
25.442	32.118	28.0071	25.237	32.1395	0.804	-0.07
32.380	32.109	29.0073	32.192	32.1279	0.583	-0.06
39.308	32.100	30.0076	39.161	32.1143	0.374	-0.04
46.221	32.092	31.0080	46.134	32.0994	0.188	-0.02
53.126	32.083	32.0084	53.105	32.0846	0.039	-0.01
60.019	32.074	33.0090	60.066	32.0700	-0.078	0.01
66.902	32.065	34.0099	67.017	32.0559	-0.172	0.03
73.773	32.057	35.0110	73.951	32.0427	-0.242	0.04
80.633	32.048	36.0122	80.868	32.0305	-0.292	0.06
87.476	32.040	37.0133	87.761	32.0190	-0.326	0.07
94.290	32.032	38.0142	94.630	32.0075	-0.360	0.08
101.083	32.024	39.0149	101.472	31.9966	-0.385	0.09
107.858	32.016	40.0154	108.288	31.9866	-0.399	0.09
121.324	32.001	42.0158	121.840	31.9669	-0.425	0.11
134.704	31.985	44.0155	135.276	31.9495	-0.425	0.11
148.006	31.970	46.0148	148.614	31.9341	-0.410	0.11
161.240	31.956	48.0142	161.851	31.9209	-0.379	0.11
174.384	31.941	50.0131	174.989	31.9084	-0.347	0.10
206.870	31.907	55.0071	207.418	31.8797	-0.265	0.09
238.882	31.874	59.9992	239.321	31.8540	-0.184	0.06
270.474	31.843	64.9999	270.830	31.8275	-0.131	0.05
301.616	31.813	70.0003	301.944	31.7998	-0.109	0.04
332.300	31.784	74.9944	332.673	31.7707	-0.112	0.04
7.464	33.234	24.0083	7.420	33.2385	0.582	-0.01
14.929	33.224	25.0078	14.746	33.2409	1.226	-0.05
22.366	33.214	26.0073	22.120	33.2358	1.100	-0.07
29.775	33.205	27.0071	29.531	33.2252	0.818	-0.06
37.161	33.195	28.0071	36.961	33.2113	0.539	-0.05
44.525	33.186	29.0073	44.404	33.1951	0.271	-0.03
51.889	33.176	30.0076	51.848	33.1796	0.079	-0.01
59.230	33.167	31.0080	59.286	33.1633	-0.094	0.01
66.583	33.158	32.0084	66.734	33.1492	-0.183	0.03
73.901	33.149	33.0090	74.109	33.1343	-0.281	0.04
81.220	33.140	34.0099	81.494	33.1212	-0.337	0.06
88.528	33.131	35.0110	88.860	33.1090	-0.375	0.07
95.813	33.122	36.0122	96.204	33.0973	-0.408	0.08
103.070	33.114	37.0133	103.518	33.0858	-0.435	0.09
110.316	33.105	38.0142	110.796	33.0756	-0.435	0.09
117.533	33.096	39.0149	118.041	33.0657	-0.433	0.09
124.716	33.088	40.0154	125.269	33.0558	-0.444	0.10

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
139.026	33.073	42.0158	139.635	33.0383	-0.438	0.10
153.257	33.057	44.0155	153.874	33.0234	-0.403	0.10
167.364	33.041	46.0148	168.001	33.0082	-0.381	0.10
181.403	33.025	48.0142	182.010	32.9951	-0.335	0.09
195.374	33.011	50.0131	195.938	32.9840	-0.289	0.08
229.844	32.976	55.0071	230.317	32.9552	-0.206	0.06
263.806	32.942	59.9992	264.139	32.9284	-0.126	0.04
297.292	32.910	64.9999	297.578	32.8993	-0.096	0.03
330.271	32.880	70.0003	330.624	32.8677	-0.107	0.04
6.803	33.871	23.0086	6.816	33.8697	-0.188	0.00
14.495	33.860	24.0083	14.401	33.8681	0.648	-0.02
22.179	33.850	25.0078	22.035	33.8615	0.649	-0.03
29.860	33.840	26.0073	29.706	33.8518	0.516	-0.04
37.532	33.830	27.0071	37.401	33.8398	0.350	-0.03
45.199	33.820	28.0071	45.109	33.8267	0.200	-0.02
52.849	33.811	29.0073	52.821	33.8126	0.052	-0.01
60.484	33.801	30.0076	60.528	33.7982	-0.072	0.01
68.103	33.792	31.0080	68.222	33.7838	-0.175	0.02
75.710	33.782	32.0084	75.897	33.7703	-0.247	0.04
83.311	33.773	33.0090	83.552	33.7579	-0.288	0.04
90.886	33.764	34.0099	91.185	33.7454	-0.330	0.05
98.448	33.755	35.0110	98.794	33.7341	-0.352	0.06
105.994	33.746	36.0122	106.380	33.7235	-0.364	0.07
113.505	33.737	37.0133	113.934	33.7129	-0.378	0.07
121.011	33.728	38.0142	121.450	33.7039	-0.363	0.07
128.467	33.720	39.0149	128.941	33.6940	-0.370	0.08
135.927	33.712	40.0154	136.404	33.6862	-0.351	0.08
150.730	33.696	42.0158	151.233	33.6696	-0.333	0.08
165.460	33.679	44.0155	165.931	33.6557	-0.285	0.07
180.076	33.664	46.0148	180.523	33.6422	-0.248	0.06
194.608	33.648	48.0142	195.008	33.6299	-0.206	0.05
209.055	33.633	50.0131	209.388	33.6186	-0.159	0.04
244.738	33.597	55.0071	244.889	33.5908	-0.062	0.02
279.879	33.563	59.9992	279.863	33.5635	0.006	-0.00
314.532	33.530	64.9999	314.432	33.5338	0.032	-0.01
348.644	33.498	70.0003	348.562	33.5007	0.024	-0.01
5.565	34.413	22.0088	5.572	34.4129	-0.138	0.00
13.444	34.403	23.0086	13.362	34.4089	0.609	-0.02
21.343	34.392	24.0083	21.204	34.4022	0.653	-0.03
29.236	34.382	25.0078	29.085	34.3922	0.515	-0.03
37.123	34.371	26.0073	36.996	34.3801	0.343	-0.03
45.005	34.361	27.0071	44.925	34.3667	0.178	-0.02
52.873	34.351	28.0071	52.860	34.3522	0.025	-0.00
60.747	34.342	29.0073	60.795	34.3386	-0.079	0.01
68.592	34.332	30.0076	68.719	34.3242	-0.185	0.02
76.432	34.322	31.0080	76.627	34.3107	-0.255	0.03
84.238	34.313	32.0084	84.513	34.2967	-0.326	0.05
92.055	34.303	33.0090	92.374	34.2849	-0.347	0.05
99.844	34.294	34.0099	100.214	34.2732	-0.371	0.06
107.628	34.285	35.0110	108.025	34.2629	-0.369	0.06

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
115.389	34.276	36.0122	115.809	34.2531	-0.365	0.07
123.110	34.267	37.0133	123.566	34.2429	-0.371	0.07
130.820	34.258	38.0142	131.283	34.2340	-0.354	0.07
138.496	34.250	39.0149	138.976	34.2252	-0.346	0.07
146.150	34.241	40.0154	146.634	34.2170	-0.331	0.07
161.389	34.224	42.0158	161.852	34.2021	-0.287	0.07
176.510	34.208	44.0155	176.950	34.1877	-0.249	0.06
191.540	34.192	46.0148	191.928	34.1747	-0.202	0.05
206.486	34.177	48.0142	206.810	34.1628	-0.157	0.04
221.330	34.161	50.0131	221.575	34.1512	-0.111	0.03
258.022	34.125	55.0071	258.062	34.1234	-0.016	0.00
294.102	34.090	59.9992	294.017	34.0935	0.029	-0.01
329.732	34.058	64.9999	329.577	34.0629	0.047	-0.02
364.785	34.026	70.0003	364.730	34.0280	0.015	-0.01
5.063	34.983	21.0089	5.107	34.9799	-0.881	0.01
13.171	34.972	22.0068	13.103	34.9766	0.514	-0.01
21.288	34.961	23.0086	21.155	34.9699	0.624	-0.03
29.416	34.950	24.0083	29.253	34.9609	0.555	-0.03
37.544	34.940	25.0078	37.383	34.9500	0.431	-0.03
45.662	34.929	26.0073	45.534	34.9373	0.279	-0.02
53.768	34.919	27.0071	53.700	34.9234	0.126	-0.01
61.862	34.909	28.0071	61.864	34.9091	-0.003	0.00
69.939	34.899	29.0073	70.023	34.8945	-0.120	0.01
77.994	34.890	30.0076	78.170	34.8797	-0.225	0.03
86.033	34.880	31.0080	86.295	34.8653	-0.305	0.04
94.065	34.870	32.0084	94.399	34.8522	-0.355	0.05
102.087	34.861	33.0090	102.473	34.8401	-0.378	0.06
110.085	34.851	34.0099	110.523	34.8284	-0.397	0.07
118.068	34.842	35.0110	118.548	34.8175	-0.406	0.07
126.044	34.833	36.0122	126.543	34.8079	-0.396	0.07
133.981	34.824	37.0133	134.505	34.7981	-0.391	0.07
141.906	34.815	38.0142	142.435	34.7895	-0.373	0.07
149.803	34.806	39.0149	150.334	34.7812	-0.354	0.07
157.684	34.798	40.0154	158.199	34.7738	-0.327	0.07
173.343	34.781	42.0158	173.831	34.7589	-0.282	0.06
188.912	34.764	44.0155	189.341	34.7457	-0.227	0.05
204.384	34.748	46.0148	204.738	34.7334	-0.173	0.04
219.720	34.733	48.0142	220.033	34.7201	-0.142	0.04
235.012	34.718	50.0131	235.218	34.7095	-0.087	0.02
272.753	34.681	55.0071	272.754	34.6809	-0.000	0.00
309.912	34.646	59.9992	309.747	34.6515	0.053	-0.02
346.529	34.613	64.9999	346.357	34.6181	0.050	-0.02
5.797	35.587	20.0090	5.718	35.5924	1.358	-0.01
14.033	35.576	21.0069	13.924	35.5826	0.774	-0.02
22.336	35.565	22.0088	22.131	35.5737	0.649	-0.02
30.629	35.554	23.0086	30.507	35.5612	0.399	-0.02
38.933	35.543	24.0083	38.861	35.5473	0.186	-0.01
47.248	35.533	25.0078	47.241	35.5330	0.015	-0.00
55.598	35.522	26.0073	55.638	35.5200	-0.071	0.01
63.936	35.512	27.0071	64.043	35.5062	-0.167	0.02

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
72.275	35.502	28.0071	72.440	35.4929	-0.229	0.02
80.590	35.492	29.0073	80.831	35.4792	-0.298	0.04
88.918	35.482	30.0076	89.203	35.4672	-0.321	0.04
97.211	35.472	31.0080	97.557	35.4547	-0.356	0.05
105.470	35.463	32.0084	105.888	35.4420	-0.396	0.06
113.758	35.453	33.0090	114.178	35.4322	-0.369	0.06
122.001	35.442	34.0099	122.438	35.4217	-0.358	0.06
130.226	35.433	35.0110	130.688	35.4119	-0.354	0.06
138.441	35.424	36.0122	138.902	35.4031	-0.333	0.06
146.633	35.415	37.0133	147.081	35.3948	-0.306	0.06
154.790	35.406	38.0142	155.236	35.3866	-0.288	0.06
162.914	35.397	39.0149	163.344	35.3785	-0.264	0.05
171.038	35.389	40.0154	171.433	35.3719	-0.231	0.05
187.185	35.372	42.0158	137.516	35.3585	-0.177	0.04
203.196	35.356	44.0155	203.462	35.3448	-0.131	0.03
219.173	35.339	46.0148	219.282	35.3345	-0.050	0.01
234.980	35.322	48.0142	234.993	35.3217	-0.005	0.00
250.743	35.306	50.0131	250.610	35.3113	0.053	-0.01
289.612	35.270	55.0071	289.232	35.2815	0.114	-0.03
327.894	35.235	59.9992	327.411	35.2507	0.147	-0.04
7.950	36.243	19.0088	7.945	36.2430	0.057	-0.00
16.429	36.231	20.0090	16.369	36.2344	0.364	-0.01
24.943	36.220	21.0089	24.848	36.2249	0.379	-0.01
33.484	36.209	22.0088	33.383	36.2140	0.301	-0.02
42.048	36.198	23.0086	41.966	36.2021	0.196	-0.01
50.613	36.187	24.0083	50.581	36.1885	0.062	-0.00
59.189	36.176	25.0078	59.218	36.1747	-0.050	0.00
67.760	36.166	26.0073	67.866	36.1605	-0.158	0.01
76.335	36.155	27.0071	76.518	36.1465	-0.240	0.02
84.911	36.145	28.0071	85.161	36.1332	-0.294	0.03
93.471	36.135	29.0073	93.793	36.1198	-0.345	0.04
102.019	36.125	30.0076	102.404	36.1071	-0.378	0.05
110.561	36.115	31.0080	110.930	36.0954	-0.389	0.05
119.081	36.105	32.0084	119.551	36.0841	-0.395	0.06
127.601	36.095	33.0090	128.079	36.0741	-0.375	0.06
136.104	36.086	34.0099	136.585	36.0647	-0.354	0.06
144.590	36.076	35.0110	145.059	36.0560	-0.325	0.06
153.059	36.067	36.0122	153.511	36.0479	-0.295	0.05
161.494	36.058	37.0133	161.927	36.0399	-0.268	0.05
169.924	36.049	38.0142	170.303	36.0330	-0.223	0.04
178.314	36.040	39.0149	178.657	36.0260	-0.192	0.04
186.682	36.031	40.0154	136.977	36.0193	-0.158	0.03
203.326	36.014	42.0158	203.512	36.0064	-0.091	0.02
219.858	35.997	44.0155	219.942	35.9938	-0.038	0.01
236.294	35.981	46.0148	236.261	35.9820	0.014	-0.00
252.629	35.965	48.0142	252.479	35.9703	0.059	-0.01
268.867	35.949	50.0131	268.592	35.9589	0.102	-0.03
308.982	35.912	55.0071	308.476	35.9286	0.164	-0.05
348.454	35.876	59.9992	347.836	35.8952	0.177	-0.05
11.609	36.923	18.0064	11.687	36.9191	-0.670	0.01

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
20.292	36.911	19.0088	20.312	36.9103	-0.101	0.00
28.980	36.900	20.0090	28.990	36.8994	-0.032	0.00
37.715	36.889	21.0089	37.729	36.8879	-0.037	0.00
46.489	36.878	22.0088	46.527	36.8758	-0.082	0.00
55.308	36.866	23.0086	55.362	36.8638	-0.098	0.01
64.145	36.855	24.0083	64.233	36.8514	-0.138	0.01
72.982	36.845	25.0078	73.119	36.8384	-0.188	0.02
81.818	36.834	26.0073	82.015	36.8253	-0.240	0.02
90.655	36.824	27.0071	90.912	36.8124	-0.284	0.03
99.492	36.813	28.0071	99.794	36.8001	-0.304	0.04
108.318	36.803	29.0073	108.669	36.7881	-0.323	0.04
117.132	36.793	30.0076	117.520	36.7767	-0.331	0.04
125.947	36.783	31.0080	126.339	36.7665	-0.311	0.04
134.739	36.773	32.0084	135.139	36.7566	-0.297	0.04
143.508	36.763	33.0090	143.900	36.7470	-0.273	0.04
152.244	36.753	34.0099	152.643	36.7372	-0.262	0.04
161.014	36.744	35.0110	161.360	36.7301	-0.215	0.04
169.727	36.734	36.0122	170.047	36.7219	-0.189	0.03
178.440	36.725	37.0133	178.698	36.7151	-0.144	0.03
187.119	36.716	38.0142	187.317	36.7082	-0.105	0.02
195.753	36.707	39.0149	195.911	36.7009	-0.081	0.02
204.388	36.698	40.0154	204.469	36.6948	-0.040	0.01
221.554	36.681	42.0158	221.504	36.6823	0.023	-0.00
238.585	36.664	44.0155	238.425	36.6693	0.067	-0.02
255.583	36.647	46.0148	255.239	36.6589	0.134	-0.03
272.411	36.632	48.0142	271.972	36.6462	0.161	-0.04
289.171	36.617	50.0131	288.612	36.6346	0.193	-0.05
330.613	36.578	55.0071	329.753	36.6041	0.260	-0.07
5.158	37.912	15.0020	5.040	37.9169	2.285	-0.01
13.920	37.899	16.0051	14.116	37.8908	-1.407	0.02
22.778	37.888	17.0071	23.001	37.8780	-0.979	0.03
31.706	37.876	18.0084	31.866	37.8689	-0.507	0.02
40.695	37.864	19.0088	40.737	37.8600	-0.227	0.01
49.723	37.853	20.0090	49.737	37.8495	-0.148	0.01
58.821	37.841	21.0089	58.880	37.8388	-0.100	0.01
67.940	37.830	22.0088	68.027	37.8267	-0.129	0.01
77.082	37.819	23.0086	77.209	37.8139	-0.165	0.01
86.248	37.808	24.0083	86.430	37.8011	-0.211	0.02
95.424	37.798	25.0078	95.661	37.7885	-0.248	0.02
104.612	37.787	26.0073	104.835	37.7763	-0.261	0.03
113.801	37.776	27.0071	114.110	37.7645	-0.272	0.03
122.995	37.766	28.0071	123.326	37.7535	-0.270	0.03
132.172	37.756	29.0073	132.535	37.7425	-0.275	0.04
141.349	37.746	30.0076	141.703	37.7325	-0.250	0.03
150.498	37.736	31.0080	150.855	37.7225	-0.238	0.03
159.653	37.725	32.0084	159.977	37.7137	-0.203	0.03
168.785	37.716	33.0090	169.075	37.7052	-0.172	0.03
177.928	37.706	34.0099	178.152	37.6981	-0.125	0.02
187.050	37.696	35.0110	187.186	37.6911	-0.073	0.01
196.148	37.686	36.0122	196.203	37.6845	-0.028	0.00

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
205.224	37.677	37.0133	205.205	37.6780	0.009	-0.00
214.267	37.669	38.0142	214.178	37.6716	0.041	-0.01
223.309	37.659	39.0149	223.095	37.6661	0.096	-0.02
232.318	37.650	40.0154	232.004	37.6604	0.135	-0.03
250.222	37.633	42.0158	249.748	37.6483	0.189	-0.04
268.012	37.616	44.0155	267.356	37.6361	0.245	-0.05
285.747	37.599	46.0148	284.891	37.6253	0.300	-0.07
303.334	37.583	48.0142	302.346	37.6127	0.326	-0.08
320.866	37.568	50.0131	319.724	37.6013	0.356	-0.09
23.735	38.694	15.0020	23.980	38.6843	-1.034	0.02
32.741	38.682	16.0051	32.991	38.6725	-0.765	0.03
41.832	38.671	17.0071	41.985	38.6648	-0.364	0.02
50.986	38.658	18.0084	51.041	38.6564	-0.108	0.01
60.202	38.647	19.0088	60.219	38.6464	-0.028	0.00
69.491	38.636	20.0090	69.500	38.6354	-0.013	0.00
78.826	38.625	21.0089	78.860	38.6233	-0.043	0.00
88.207	38.614	22.0088	88.282	38.6108	-0.085	0.01
97.622	38.603	23.0086	97.744	38.5982	-0.125	0.01
107.048	38.592	24.0083	107.229	38.5853	-0.170	0.02
116.497	38.581	25.0078	116.720	38.5731	-0.192	0.02
125.957	38.570	26.0073	126.210	38.5615	-0.201	0.02
135.417	38.560	27.0071	135.695	38.5501	-0.205	0.02
144.866	38.549	28.0071	145.158	38.5390	-0.201	0.03
154.350	38.539	29.0073	154.611	38.5297	-0.170	0.02
163.799	38.528	30.0076	164.050	38.5201	-0.153	0.02
173.249	38.519	31.0080	173.478	38.5114	-0.132	0.02
182.698	38.509	32.0084	182.851	38.5035	-0.084	0.01
192.113	38.499	33.0090	192.218	38.4954	-0.054	0.01
201.563	38.488	34.0099	201.523	38.4893	0.020	-0.00
210.968	38.479	35.0110	210.852	38.4825	0.055	-0.01
220.361	38.470	36.0122	220.156	38.4762	0.093	-0.02
229.733	38.461	37.0133	229.428	38.4701	0.133	-0.02
239.058	38.452	38.0142	238.680	38.4635	0.158	-0.03
248.430	38.442	39.0149	247.866	38.4591	0.227	-0.04
257.721	38.433	40.0154	257.056	38.4531	0.258	-0.05
276.283	38.416	42.0158	275.365	38.4427	0.332	-0.07
294.709	38.399	44.0155	293.581	38.4312	0.383	-0.08
312.999	38.383	46.0148	311.711	38.4185	0.411	-0.09
331.256	38.367	48.0142	329.771	38.4072	0.448	-0.11
51.884	39.383	16.0051	51.867	39.3836	0.033	-0.00
61.151	39.371	17.0071	61.002	39.3765	0.244	-0.01
70.498	39.360	18.0084	70.303	39.3669	0.277	-0.02
79.930	39.349	19.0088	79.716	39.3559	0.267	-0.02
89.407	39.337	20.0090	89.240	39.3427	0.187	-0.01
98.957	39.326	21.0089	98.848	39.3295	0.110	-0.01
108.542	39.315	22.0088	108.520	39.3157	0.021	-0.00
118.167	39.304	23.0086	118.225	39.3023	-0.049	0.00
127.814	39.293	24.0083	127.942	39.2891	-0.100	0.01
137.501	39.283	25.0078	137.669	39.2773	-0.122	0.01
147.177	39.272	26.0073	147.388	39.2654	-0.143	0.02

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
156.898	39.261	27.0071	157.085	39.2552	-0.119	0.01
166.586	39.251	28.0071	166.801	39.2446	-0.129	0.02
176.285	39.241	29.0073	176.468	39.2349	-0.104	0.01
185.984	39.231	30.0076	186.146	39.2260	-0.087	0.01
195.683	39.220	31.0080	195.768	39.2178	-0.044	0.01
205.371	39.211	32.0084	205.403	39.2100	-0.016	0.00
215.082	39.200	33.0090	214.944	39.2037	0.064	-0.01
224.770	39.190	34.0099	224.535	39.1973	0.104	-0.02
234.435	39.181	35.0110	234.031	39.1910	0.151	-0.03
244.089	39.171	36.0122	243.615	39.1850	0.195	-0.03
253.744	39.163	37.0133	253.139	39.1797	0.238	-0.04
263.364	39.154	38.0142	262.638	39.1742	0.276	-0.05
272.951	39.145	39.0149	272.099	39.1684	0.312	-0.06
282.538	39.136	40.0154	281.552	39.1632	0.349	-0.07
301.610	39.118	42.0158	300.360	39.1521	0.414	-0.09
320.581	39.102	44.0155	319.103	39.1406	0.461	-0.10
339.416	39.085	46.0148	337.772	39.1276	0.484	-0.11
80.489	40.010	17.0071	80.070	40.0233	0.520	-0.03
90.015	39.999	18.0084	89.600	40.0117	0.461	-0.03
99.626	39.987	19.0088	99.257	39.9984	0.371	-0.03
109.313	39.976	20.0090	109.035	39.9843	0.255	-0.02
119.068	39.965	21.0089	118.894	39.9703	0.146	-0.01
128.858	39.954	22.0088	128.801	39.9560	0.044	-0.00
138.692	39.943	23.0086	138.710	39.9425	-0.013	0.00
148.557	39.932	24.0083	148.642	39.9297	-0.057	0.01
158.454	39.922	25.0078	158.578	39.9181	-0.078	0.01
168.368	39.911	26.0073	168.498	39.9073	-0.077	0.01
178.294	39.901	27.0071	178.409	39.8973	-0.065	0.01
188.237	39.890	28.0071	188.296	39.8883	-0.031	0.00
198.158	39.880	29.0073	198.183	39.8792	-0.013	0.00
208.095	39.869	30.0076	208.017	39.8712	0.038	-0.01
218.021	39.860	31.0080	217.879	39.8635	0.065	-0.01
227.936	39.850	32.0084	227.697	39.8562	0.105	-0.02
237.806	39.840	33.0090	237.488	39.8482	0.134	-0.02
247.801	39.829	34.0099	247.246	39.8442	0.224	-0.04
257.693	39.820	35.0110	257.012	39.8380	0.264	-0.05
267.620	39.810	36.0122	266.747	39.8332	0.326	-0.06
277.513	39.801	37.0133	276.490	39.8281	0.369	-0.07
287.371	39.792	38.0142	286.216	39.8226	0.402	-0.08
297.230	39.784	39.0149	295.919	39.8177	0.441	-0.09
307.045	39.774	40.0154	305.555	39.8122	0.485	-0.10
326.594	39.757	42.0158	324.871	39.8007	0.528	-0.11
346.053	39.741	44.0155	344.114	39.7888	0.560	-0.12
100.092	40.599	17.0071	99.162	40.6261	0.929	-0.07
109.767	40.587	18.0084	108.956	40.6107	0.738	-0.06
119.534	40.576	19.0088	118.905	40.5944	0.526	-0.04
129.390	40.565	20.0090	128.939	40.5783	0.349	-0.03
139.304	40.555	21.0089	139.032	40.5624	0.195	-0.02
149.274	40.544	22.0088	149.153	40.5473	0.081	-0.01
159.301	40.533	23.0086	159.268	40.5336	0.021	-0.00

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
169.350	40.521	24.0083	169.374	40.5207	-0.014	0.00
179.412	40.511	25.0078	179.514	40.5085	-0.057	0.01
189.508	40.501	26.0073	189.624	40.4977	-0.061	0.01
199.671	40.491	27.0071	199.734	40.4891	-0.032	0.00
209.801	40.480	28.0071	209.796	40.4801	0.002	-0.00
219.930	40.470	29.0073	219.868	40.4717	0.028	-0.00
230.060	40.460	30.0076	229.918	40.4638	0.062	-0.01
240.224	40.451	31.0080	239.957	40.4574	0.111	-0.02
250.354	40.441	32.0084	249.977	40.4507	0.150	-0.02
260.518	40.432	33.0090	259.993	40.4453	0.202	-0.03
270.648	40.421	34.0099	269.914	40.4395	0.271	-0.05
280.812	40.412	35.0110	279.875	40.4349	0.334	-0.06
290.946	40.402	36.0122	289.830	40.4300	0.384	-0.07
301.074	40.393	37.0133	299.761	40.4254	0.436	-0.08
311.103	40.384	38.0142	309.656	40.4188	0.465	-0.09
321.167	40.375	39.0149	319.550	40.4136	0.504	-0.10
331.228	40.365	40.0154	329.404	40.4086	0.551	-0.11
351.221	40.348	42.0158	349.127	40.3969	0.596	-0.12
129.341	41.129	18.0084	128.153	41.1611	0.918	-0.08
139.278	41.117	19.0088	138.361	41.1421	0.658	-0.06
149.277	41.107	20.0090	148.648	41.1233	0.421	-0.04
159.339	41.096	21.0089	158.969	41.1055	0.232	-0.02
169.469	41.085	22.0088	169.313	41.0894	0.092	-0.01
179.660	41.074	23.0086	179.625	41.0752	0.020	-0.00
189.880	41.064	24.0083	189.944	41.0621	-0.034	0.00
200.134	41.053	25.0078	200.235	41.0504	-0.050	0.01
210.411	41.042	26.0073	210.514	41.0399	-0.049	0.01
220.711	41.033	27.0071	220.810	41.0304	-0.045	0.01
231.035	41.022	28.0071	231.033	41.0221	0.001	-0.00
241.346	41.011	29.0073	241.239	41.0140	0.044	-0.01
251.681	41.002	30.0076	251.453	41.0071	0.090	-0.01
261.976	40.992	31.0080	261.666	40.9996	0.118	-0.02
272.316	40.982	32.0084	271.848	40.9937	0.172	-0.03
282.673	40.973	33.0090	282.019	40.9886	0.232	-0.04
292.986	40.963	34.0099	292.159	40.9827	0.282	-0.05
303.344	40.954	35.0110	302.300	40.9783	0.344	-0.06
313.622	40.945	36.0122	312.439	40.9723	0.377	-0.07
323.923	40.936	37.0133	322.567	40.9672	0.419	-0.08
334.225	40.927	38.0142	332.676	40.9625	0.463	-0.09
344.492	40.919	39.0149	342.739	40.9573	0.494	-0.09
159.487	41.635	19.0088	158.276	41.6653	0.760	-0.07
169.617	41.624	20.0090	168.822	41.6434	0.469	-0.05
179.815	41.613	21.0089	179.379	41.6235	0.242	-0.03
190.115	41.602	22.0088	189.927	41.6066	0.099	-0.01
200.415	41.592	23.0086	200.472	41.5904	-0.028	0.00
210.816	41.581	24.0083	210.968	41.5775	-0.072	0.01
221.252	41.570	25.0078	221.431	41.5661	-0.081	0.01
231.654	41.560	26.0073	231.830	41.5547	-0.101	0.01
242.158	41.550	27.0071	242.319	41.5463	-0.067	0.01
252.697	41.540	28.0071	252.733	41.5392	-0.014	0.00

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
263.201	41.530	29.0073	263.106	41.5319	0.036	-0.01
273.706	41.520	30.0076	273.431	41.5250	0.079	-0.01
284.235	41.510	31.0080	283.835	41.5191	0.140	-0.02
294.716	41.501	32.0084	294.178	41.5126	0.182	-0.03
305.255	41.491	33.0090	304.493	41.5077	0.250	-0.04
315.794	41.481	34.0099	314.819	41.5030	0.309	-0.05
326.300	41.472	35.0110	325.141	41.4978	0.355	-0.06
336.840	41.464	36.0122	335.465	41.4937	0.408	-0.07
347.312	41.455	37.0133	345.731	41.4883	0.441	-0.08
179.205	42.109	19.0088	177.678	42.1453	0.852	-0.09
189.505	42.099	20.0090	188.534	42.1212	0.512	-0.05
199.838	42.089	21.0089	199.401	42.0992	0.219	-0.02
210.240	42.078	22.0088	210.169	42.0800	0.034	-0.00
220.744	42.067	23.0086	220.875	42.0643	-0.059	0.01
231.316	42.057	24.0083	231.565	42.0514	-0.108	0.01
241.865	42.047	25.0078	242.225	42.0389	-0.149	0.02
252.494	42.036	26.0073	252.820	42.0292	-0.129	0.02
263.135	42.027	27.0071	263.416	42.0203	-0.107	0.01
273.810	42.016	28.0071	273.954	42.0129	-0.053	0.01
284.449	42.006	29.0073	284.500	42.0052	-0.018	0.00
295.112	41.996	30.0076	295.015	41.9985	0.033	-0.01
305.764	41.987	31.0080	305.542	41.9920	0.072	-0.01
316.473	41.978	32.0084	316.033	41.9870	0.139	-0.02
327.149	41.969	33.0090	326.544	41.9816	0.185	-0.03
337.824	41.960	34.0099	337.018	41.9764	0.239	-0.04
348.500	41.950	35.0110	347.488	41.9714	0.290	-0.05
211.053	42.581	20.0090	209.749	42.6100	0.618	-0.07
221.489	42.571	21.0089	220.887	42.5845	0.272	-0.03
232.026	42.561	22.0088	231.941	42.5633	0.037	-0.00
242.665	42.550	23.0086	242.838	42.5461	-0.071	0.01
253.306	42.540	24.0083	253.752	42.5306	-0.176	0.02
264.015	42.530	25.0078	264.589	42.5178	-0.218	0.03
274.757	42.520	26.0073	275.390	42.5069	-0.230	0.03
285.534	42.510	27.0071	286.135	42.4976	-0.211	0.03
296.311	42.500	28.0071	296.866	42.4890	-0.188	0.03
307.155	42.491	29.0073	307.585	42.4823	-0.140	0.02
317.966	42.482	30.0076	318.284	42.4755	-0.100	0.02
328.811	42.473	31.0080	328.964	42.4697	-0.047	0.01
339.656	42.464	32.0084	339.619	42.4643	0.011	-0.00
350.502	42.455	33.0090	350.284	42.4590	0.062	-0.01
241.686	42.999	21.0089	240.962	43.0141	0.299	-0.04
252.326	42.989	22.0088	252.259	42.9903	0.027	-0.00
263.069	42.978	23.0086	263.431	42.9711	-0.137	0.02
273.812	42.968	24.0083	274.526	42.9540	-0.261	0.03
284.690	42.958	25.0078	285.542	42.9413	-0.299	0.04
295.535	42.949	26.0073	296.513	42.9293	-0.331	0.05
306.448	42.939	27.0071	307.437	42.9197	-0.323	0.05
317.428	42.930	28.0071	318.339	42.9122	-0.287	0.04
328.340	42.921	29.0073	329.233	42.9040	-0.272	0.04
339.320	42.912	30.0076	340.086	42.8976	-0.226	0.03

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
350.301	42.903	31.0080	350.910	42.8917	-0.174	0.03
263.293	43.438	21.0089	262.551	43.4531	0.282	-0.03
274.103	43.429	22.0088	274.180	43.4273	-0.028	0.00
284.982	43.419	23.0086	285.633	43.4061	-0.228	0.03
295.928	43.408	24.0083	296.903	43.3889	-0.329	0.04
306.909	43.397	25.0078	308.105	43.3745	-0.390	0.05
317.991	43.388	26.0073	319.268	43.3636	-0.402	0.06
329.040	43.379	27.0071	330.389	43.3534	-0.410	0.06
340.124	43.370	28.0071	341.458	43.3447	-0.392	0.06
351.242	43.360	29.0073	352.489	43.3375	-0.355	0.05
293.888	43.802	22.0088	293.556	43.8083	0.113	-0.01
304.767	43.792	23.0086	305.286	43.7826	-0.170	0.02
315.748	43.782	24.0083	316.826	43.7621	-0.341	0.05
326.762	43.773	25.0078	328.305	43.7449	-0.472	0.06
337.879	43.763	26.0073	339.637	43.7315	-0.521	0.07
348.995	43.754	27.0071	350.912	43.7196	-0.549	0.08
324.091	44.155	23.0086	325.065	44.1377	-0.301	0.04
335.208	44.146	24.0083	336.919	44.1156	-0.510	0.07
346.427	44.136	25.0078	348.554	44.0984	-0.614	0.08
1.361	38.240	13.8470	1.355	38.2406	0.460	-0.00
1.361	0.166	100.0000	1.361	0.1659	0.007	-0.01
1.361	0.136	122.2220	1.361	0.1356	0.002	-0.00
1.361	0.115	144.4440	1.361	0.1147	0.001	-0.00
1.361	0.099	166.6670	1.361	0.0994	0.000	-0.00
1.361	0.088	188.8890	1.361	0.0877	0.001	-0.00
1.361	0.078	211.1110	1.361	0.0785	0.001	-0.00
1.361	0.071	233.3330	1.361	0.0710	0.001	-0.00
1.361	0.065	255.5560	1.361	0.0648	0.001	-0.00
1.361	0.060	277.7780	1.361	0.0597	0.000	-0.00
1.361	0.055	300.0000	1.361	0.0552	0.001	-0.00
1.361	0.051	322.2220	1.361	0.0514	0.002	-0.00
1.361	0.046	361.1110	1.361	0.0459	0.001	-0.00
1.361	0.037	444.4440	1.361	0.0373	0.002	-0.00
1.361	0.030	555.5560	1.361	0.0298	0.003	-0.00
1.361	0.015	1111.1110	1.361	0.0149	0.005	-0.00
1.361	0.010	1666.6670	1.361	0.0100	0.010	-0.01
1.361	0.007	2222.2220	1.357	0.0075	0.280	-0.28
10.207	38.491	14.1440	10.618	38.4746	-4.026	0.04
10.207	1.246	100.0000	10.206	1.2462	0.010	-0.01
10.207	1.014	122.2220	10.208	1.0141	-0.012	0.01
10.207	0.856	144.4440	10.209	0.8562	-0.019	0.02
10.207	0.741	166.6670	10.209	0.7413	-0.021	0.02
10.207	0.654	188.8890	10.209	0.6539	-0.021	0.02
10.207	0.585	211.1110	10.209	0.5851	-0.020	0.02
10.207	0.530	233.3330	10.209	0.5294	-0.020	0.02
10.207	0.484	255.5560	10.209	0.4835	-0.020	0.02
10.207	0.445	277.7780	10.209	0.4449	-0.019	0.02
10.207	0.412	300.0000	10.209	0.4121	-0.018	0.02
10.207	0.384	322.2220	10.209	0.3838	-0.017	0.02
10.207	0.343	361.1110	10.209	0.3426	-0.015	0.02

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
10.207	0.279	444.4440	10.208	0.2786	-0.012	0.01
10.207	0.223	555.5560	10.208	0.2230	-0.008	0.01
10.207	0.112	1111.1110	10.207	0.1117	0.002	-0.00
10.207	0.075	1666.6670	10.206	0.0745	0.007	-0.01
10.207	0.056	2222.2220	10.196	0.0559	0.106	-0.11
51.034	39.544	15.4330	51.102	39.5413	-0.134	0.01
51.034	6.188	100.0000	51.204	6.1679	-0.333	0.32
51.034	4.961	122.2220	51.114	4.9537	-0.157	0.15
51.034	4.165	144.4440	51.078	4.1617	-0.086	0.08
51.034	3.600	166.6670	51.063	3.5980	-0.056	0.05
51.034	3.175	188.8890	51.056	3.1738	-0.044	0.04
51.034	2.843	211.1110	51.054	2.8418	-0.040	0.04
51.034	2.575	233.3330	51.054	2.5742	-0.039	0.04
51.034	2.355	255.5560	51.055	2.3536	-0.040	0.04
51.034	2.169	277.7780	51.055	2.1684	-0.041	0.04
51.034	2.012	300.0000	51.055	2.0107	-0.042	0.04
51.034	1.875	322.2220	51.055	1.8746	-0.042	0.04
51.034	1.677	361.1110	51.055	1.6765	-0.041	0.04
51.034	1.368	444.4440	51.052	1.3677	-0.035	0.03
51.034	1.099	555.5560	51.046	1.0985	-0.024	0.02
51.034	0.554	1111.1110	51.027	0.5544	0.014	-0.01
51.034	0.371	1666.6670	51.020	0.3708	0.027	-0.03
51.034	0.278	2222.2220	50.996	0.2786	0.075	-0.07
102.069	40.689	16.9010	101.151	40.7158	0.899	-0.07
102.069	11.822	100.0000	102.735	11.7553	-0.653	0.57
102.069	9.488	122.2220	102.387	9.4614	-0.312	0.28
102.069	7.973	144.4440	102.185	7.9649	-0.114	0.10
102.069	6.903	166.6670	102.091	6.9015	-0.021	0.02
102.069	6.101	188.8890	102.052	6.1015	0.016	-0.01
102.069	5.474	211.1110	102.042	5.4752	0.026	-0.02
102.069	4.969	233.3330	102.045	4.9699	0.024	-0.02
102.069	4.552	255.5560	102.053	4.5527	0.016	-0.01
102.069	4.202	277.7780	102.062	4.2020	0.007	-0.01
102.069	3.903	300.0000	102.070	3.9027	-0.001	0.00
102.069	3.644	322.2220	102.078	3.6440	-0.009	0.01
102.069	3.267	361.1110	102.087	3.2665	-0.018	0.02
102.069	2.676	444.4440	102.095	2.6755	-0.026	0.02
102.069	2.158	555.5560	102.091	2.1573	-0.022	0.02
102.069	1.098	1111.1110	102.041	1.0984	0.027	-0.03
102.069	0.737	1666.6670	102.018	0.7370	0.049	-0.05
102.069	0.554	2222.2220	101.979	0.5546	0.088	-0.09
204.137	42.547	19.5230	202.551	42.5822	0.777	-0.08
204.137	20.039	100.0000	203.387	20.0881	0.367	-0.24
204.137	16.723	122.2220	203.943	16.7347	0.095	-0.07
204.137	14.339	144.4440	203.868	14.3534	0.132	-0.10
204.137	12.567	166.6670	203.724	12.5878	0.202	-0.16
204.137	11.204	188.8890	203.642	11.2268	0.242	-0.20
204.137	10.122	211.1110	203.624	10.1436	0.251	-0.21
204.137	9.240	233.3330	203.647	9.2594	0.240	-0.21
204.137	8.507	255.5560	203.632	8.5227	0.218	-0.19

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
204.137	7.885	277.7780	203.745	7.8985	0.192	-0.17
204.137	7.352	300.0000	203.800	7.3624	0.165	-0.15
204.137	6.888	322.2220	203.852	6.8964	0.140	-0.12
204.137	6.206	361.1110	203.931	6.2118	0.101	-0.09
204.137	5.126	444.4440	204.045	5.1285	0.045	-0.04
204.137	4.166	555.5560	204.112	4.1662	0.012	-0.01
204.137	2.156	1111.1110	204.066	2.1569	0.035	-0.03
204.137	1.455	1666.6670	203.998	1.4563	0.068	-0.07
204.137	1.098	2222.2220	203.922	1.0992	0.105	-0.10
408.274	45.367	24.0220	408.904	45.3566	-0.154	0.02
408.274	45.285	24.4440	409.560	45.2642	-0.315	0.05
408.274	44.848	26.6670	411.155	44.8012	-0.706	0.10
408.274	44.399	28.8890	410.831	44.3572	-0.626	0.10
408.274	43.940	31.1110	409.700	43.9161	-0.349	0.06
408.274	43.472	33.3330	408.347	43.4704	-0.018	0.00
408.274	42.994	35.5560	407.078	43.0162	0.293	-0.05
408.274	42.509	37.7780	406.007	42.5525	0.555	-0.10
408.274	41.647	41.6670	404.774	41.7178	0.857	-0.17
408.274	40.397	47.2220	404.371	40.4836	0.956	-0.21
408.274	29.435	100.0000	408.589	29.4244	-0.077	0.04
408.274	25.950	122.2220	408.243	25.9513	0.008	-0.00
408.274	23.137	144.4440	407.935	23.1483	0.083	-0.05
408.274	20.849	166.6670	407.546	20.8732	0.178	-0.11
408.274	18.970	188.8890	407.199	19.0038	0.263	-0.18
408.274	17.406	211.1110	406.960	17.4456	0.322	-0.23
408.274	16.087	233.3330	406.834	16.1288	0.353	-0.26
408.274	14.961	255.5560	406.804	15.0016	0.360	-0.27
408.274	13.988	277.7780	406.838	14.0259	0.352	-0.27
408.274	13.138	300.0000	406.916	13.1728	0.333	-0.26
408.274	12.390	322.2220	407.020	12.4202	0.307	-0.25
408.274	11.272	361.1110	407.229	11.2959	0.256	-0.21
408.274	9.459	444.4440	407.655	9.4715	0.152	-0.13
408.274	7.800	555.5560	408.051	7.8033	0.055	-0.05
408.274	4.168	1111.1110	408.337	4.1666	-0.030	0.03
408.274	2.845	1666.6670	408.229	2.8453	0.011	-0.01
408.274	2.159	2222.2220	408.029	2.1604	0.060	-0.06
544.366	46.867	26.6750	542.785	46.8905	0.290	-0.05
544.366	46.474	28.8890	547.776	46.4252	-0.626	0.10
544.366	46.071	31.1110	549.026	46.0057	-0.856	0.14
544.366	45.661	33.3330	548.283	45.6054	-0.720	0.12
544.366	45.243	35.5560	546.612	45.2111	-0.413	0.07
544.366	44.820	37.7780	544.604	44.8165	-0.044	0.01
544.366	44.068	41.6670	541.286	44.1155	0.566	-0.11
544.366	42.979	47.2220	538.167	43.0821	1.139	-0.24
544.366	41.890	52.7780	537.395	42.0148	1.281	-0.30
544.366	40.823	58.3330	538.889	40.9272	1.006	-0.26
544.366	33.467	100.0000	552.445	33.2708	-1.484	0.59
544.366	30.108	122.2220	550.449	29.9535	-1.117	0.51
544.366	27.283	144.4440	548.721	27.1702	-0.800	0.41
544.366	24.908	166.6670	547.215	24.8340	-0.523	0.30

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
544.366	22.901	188.8890	545.997	22.8594	-0.300	0.18
544.366	21.192	211.1110	545.078	21.1747	-0.131	0.08
544.366	19.725	233.3330	544.426	19.7234	-0.011	0.01
544.366	18.452	255.5560	543.994	18.4611	0.068	-0.05
544.366	17.339	277.7780	543.727	17.3538	0.117	-0.08
544.366	16.357	300.0000	543.585	16.3745	0.144	-0.10
544.366	15.485	322.2220	543.532	15.5022	0.153	-0.11
544.366	14.169	361.1110	543.580	14.1846	0.144	-0.11
544.366	12.002	444.4440	543.933	12.0099	0.079	-0.06
544.366	9.984	555.5560	544.439	9.9825	-0.013	0.01
544.366	5.441	1111.1110	545.131	5.4342	-0.141	0.13
544.366	3.741	1666.6670	544.892	3.7373	-0.095	0.09
544.366	2.849	2222.2220	544.542	2.8482	-0.032	0.03
680.457	48.173	29.1370	670.176	48.3285	1.511	-0.32
680.457	47.848	31.1110	679.713	47.8582	0.109	-0.02
680.457	47.476	33.3330	684.740	47.4210	-0.629	0.12
680.457	47.097	35.5560	686.032	47.0269	-0.828	0.15
680.457	46.714	37.7780	685.318	46.6532	-0.714	0.13
680.457	46.032	41.6670	681.697	46.0164	-0.182	0.03
680.457	45.045	47.2220	675.892	45.1058	0.671	-0.14
680.457	44.054	52.7780	672.087	44.1740	1.230	-0.27
680.457	43.079	58.3330	671.090	43.2207	1.377	-0.33
680.457	42.135	63.8890	673.014	42.2535	1.094	-0.28
680.457	41.240	69.4440	677.828	41.2833	0.386	-0.11
680.457	40.408	75.0000	685.624	40.3193	-0.759	0.22
680.457	36.590	100.0000	689.268	36.2299	-2.764	0.98
680.457	33.400	122.2220	696.960	33.0656	-2.425	1.00
680.457	30.629	144.4440	694.053	30.3463	-1.998	0.92
680.457	28.240	166.6570	691.181	28.0144	-1.576	0.80
680.457	26.179	188.8890	688.693	26.0060	-1.210	0.66
680.457	24.393	211.1110	686.683	24.2642	-0.915	0.53
680.457	22.837	233.3330	685.123	22.7419	-0.686	0.42
680.457	21.471	255.5560	683.950	21.4013	-0.513	0.32
680.457	20.264	277.7780	683.083	20.2124	-0.386	0.25
680.457	19.189	300.0000	682.461	19.1509	-0.294	0.20
680.457	18.227	322.2220	682.027	18.1974	-0.231	0.16
680.457	16.763	361.1110	681.592	16.7429	-0.167	0.12
680.457	14.320	444.4440	681.418	14.3047	-0.141	0.11
680.457	12.008	555.5560	681.734	11.9896	-0.188	0.15
680.457	6.667	1111.1110	682.556	6.6486	-0.308	0.28
680.457	4.615	1666.6670	682.193	4.6038	-0.254	0.23
680.457	3.527	2222.2220	681.639	3.5211	-0.174	0.16
0.078	38.125	14.0000	0.129	38.1229	-65.368	0.01
0.078	0.069	14.0000	0.078	0.0690	0.112	-0.11
0.133	37.700	15.0000	0.282	37.6933	-113.027	0.02
0.133	0.110	15.0000	0.133	0.1104	-0.086	0.09
0.212	37.258	16.0000	0.328	37.2525	-54.483	0.02
0.212	0.168	16.0000	0.213	0.1674	-0.149	0.15
0.324	36.797	17.0000	0.376	36.7941	-15.924	0.01
0.324	0.244	17.0000	0.325	0.2431	-0.153	0.16

PIN	D IN	T IN	P CAL	D CAL	P DIF	D DIF
0.474	36.313	18.0000	0.474	36.3134	0.024	-0.00
0.474	0.341	18.0000	0.475	0.3407	-0.139	0.15
0.671	35.805	19.0000	0.644	35.8066	3.971	-0.00
0.671	0.464	19.0000	0.672	0.4637	-0.128	0.14
0.920	35.268	20.0000	0.892	35.2700	3.115	-0.01
0.920	0.616	20.0000	0.922	0.6156	-0.124	0.14
1.231	34.699	21.0000	1.219	34.7000	0.986	-0.00
1.231	0.802	21.0000	1.233	0.8008	-0.125	0.14
1.611	34.094	22.0000	1.627	34.0923	-0.997	0.00
1.611	1.026	22.0000	1.613	1.0242	-0.124	0.15
2.067	33.446	23.0000	2.117	33.4415	-2.408	0.01
2.067	1.293	23.0000	2.069	1.2914	-0.112	0.14
2.608	32.751	24.0000	2.632	32.7413	-3.219	0.03
2.608	1.611	24.0000	2.610	1.6098	-0.084	0.11
3.242	31.998	25.0000	3.356	31.9833	-3.526	0.05
3.242	1.989	25.0000	3.243	1.9881	-0.038	0.05
3.976	31.177	26.0000	4.113	31.1566	-3.431	0.07
3.976	2.437	26.0000	3.976	2.4383	0.023	-0.03
4.821	30.274	27.0000	4.966	30.2465	-3.016	0.09
4.821	2.972	27.0000	4.817	2.9761	0.091	-0.14
5.784	29.265	28.0000	5.920	29.2326	-2.346	0.11
5.784	3.615	28.0000	5.776	3.6238	0.148	-0.25
6.876	28.116	29.0000	6.979	28.0836	-1.496	0.11
6.876	4.401	29.0000	6.864	4.4153	0.172	-0.33
8.107	26.768	30.0000	8.155	26.7468	-0.593	0.08
8.107	5.390	30.0000	8.096	5.4067	0.138	-0.31
9.489	25.104	31.0000	9.476	25.1141	0.140	-0.04
9.489	6.703	31.0000	9.436	6.7105	0.039	-0.12
11.039	22.801	32.0000	11.000	22.8690	0.356	-0.30
11.039	8.670	32.0000	11.045	8.6469	-0.054	0.27

D IN	T IN	CV IN	CV CAL	CV DIF	
10.9500	33.497	17.560	16.973	3.34	-1.12
10.9500	34.695	16.070	16.233	-1.02	-0.57
10.9500	36.367	15.090	15.432	-2.26	-0.24
10.9500	38.150	14.520	14.801	-1.94	-0.16
10.9500	40.105	14.140	14.303	-1.15	-0.02
10.9500	42.325	13.880	13.912	-0.23	0.04
10.9500	44.538	13.690	13.654	0.26	0.09
10.9500	46.624	13.610	13.497	0.83	0.12
10.9500	48.607	13.560	13.408	1.12	0.09
10.9500	50.555	13.570	13.367	1.50	0.12
10.9400	59.757	13.740	13.609	0.95	0.05
10.9400	70.241	14.680	14.528	1.03	0.06
13.3000	34.216	17.570	16.736	4.95	-1.33
13.3000	36.402	15.270	15.610	-2.22	-0.49
13.2900	38.384	14.560	14.869	-2.12	-0.32
13.2900	40.214	14.150	14.384	-1.65	-0.15
13.2900	42.107	13.920	14.025	-0.75	-0.11
13.2900	43.985	13.770	13.776	-0.04	-0.05
13.2900	45.940	13.680	13.600	0.59	-0.00
13.2900	47.994	13.610	13.486	0.91	0.02
13.2900	50.057	13.600	13.430	1.25	0.05
13.2800	59.868	13.880	13.690	1.37	0.05
13.2800	69.974	14.680	14.596	0.57	0.08
13.2700	80.206	16.030	15.994	0.22	0.04
13.2700	90.055	17.570	17.631	-0.34	0.05
16.1900	33.889	18.640	16.650	10.68	-0.24
16.1900	36.035	15.200	15.502	-1.99	-0.18
16.1900	38.194	14.380	14.724	-2.39	-0.18
16.1900	42.244	13.810	13.894	-0.61	-0.11
16.1900	44.245	13.690	13.674	0.12	-0.06
16.1800	46.166	13.630	13.540	0.66	-0.07
16.1800	49.986	13.610	13.434	1.29	0.01
16.1700	59.894	13.920	13.775	1.04	2.63
16.1600	69.931	14.830	14.717	0.76	0.04
16.1600	80.052	16.100	16.120	-0.12	0.07
16.1500	89.943	17.700	17.772	-0.41	0.02
18.6900	33.316	17.360	16.157	6.93	0.41
18.6900	34.425	15.470	15.576	-0.68	0.02
18.6900	36.217	14.460	14.858	-2.76	-0.19
18.6900	38.159	14.010	14.314	-2.17	-0.26
18.6900	40.040	13.780	13.953	-1.26	-0.21
18.6900	41.969	13.560	13.705	-0.33	-0.17
18.6800	44.018	13.560	13.539	0.15	-0.17
18.6800	46.142	13.550	13.443	0.79	-0.08
18.6800	48.238	13.540	13.407	0.98	-0.03
18.6800	50.249	13.560	13.415	1.07	0.00
18.6700	60.335	14.010	13.898	0.87	0.08
18.6600	69.404	14.810	14.777	0.22	0.05
18.6500	79.324	16.180	16.241	-0.38	0.04

D IN	T IN	CV IN	CV CAL	CV DIF	
18.6400	89.331	17.590	17.814	-1.27	-0.00
22.9200	33.696	13.810	14.290	-3.47	-0.62
22.9200	35.943	13.510	13.819	-2.29	-0.51
22.9100	40.010	13.380	13.408	-0.21	-0.33
22.9100	41.943	13.380	13.335	0.33	-0.23
22.9100	43.900	13.390	13.311	0.59	-0.13
22.9000	45.976	13.450	13.326	0.92	-0.10
22.9000	48.043	13.490	13.372	0.88	-0.04
22.9000	50.086	13.590	13.443	1.08	0.02
22.8800	60.017	14.150	14.064	0.61	0.07
22.8700	69.823	15.100	15.083	0.11	0.07
22.8500	79.870	16.550	16.506	0.26	0.01
22.8400	90.319	18.250	18.263	-0.07	-0.01
25.4600	33.107	13.190	13.624	-3.29	-0.33
25.4600	34.245	13.180	13.483	-2.30	-0.33
25.4600	34.622	13.200	13.445	-1.86	-0.35
25.4500	35.434	13.190	13.379	-1.43	-0.34
25.4500	36.926	13.210	13.290	-0.60	-0.30
25.4500	37.354	13.230	13.273	-0.32	-0.28
25.4500	39.301	13.280	13.230	0.38	-0.19
25.4500	41.109	13.330	13.232	0.73	-0.11
25.4400	45.860	13.450	13.352	0.73	0.01
25.4300	47.949	13.550	13.439	0.82	0.03
25.4300	50.060	13.630	13.543	0.64	0.08
25.4100	59.845	14.250	14.220	0.21	0.11
25.3900	70.316	15.340	15.330	0.07	0.07
25.3800	79.472	16.650	16.628	0.13	0.07
25.3600	89.674	18.300	18.327	-0.15	0.04
30.7300	27.532	12.550	12.862	-2.49	-0.04
30.7200	29.628	12.700	12.849	-1.18	-0.10
30.7100	32.215	12.950	12.913	0.28	-0.09
30.7100	34.262	13.120	13.003	0.89	-0.03
30.7000	36.344	13.250	13.114	1.03	-0.01
30.7000	38.439	13.370	13.236	1.01	0.05
30.6900	40.505	13.470	13.361	0.81	0.06
30.6900	42.494	13.540	13.483	0.42	0.10
30.6800	43.881	13.640	13.567	0.53	0.09
30.6800	45.898	13.740	13.690	0.36	0.12
30.6700	47.880	13.860	13.811	0.35	0.11
30.6700	49.879	13.970	13.937	0.24	0.13
30.6400	60.070	14.690	14.683	0.05	0.10
30.6100	69.365	15.630	15.637	-0.05	0.05
30.5900	79.554	17.040	17.036	0.02	0.07
36.7700	20.140	11.340	11.532	-1.69	-0.01
36.7600	22.205	11.800	11.836	-0.31	-0.01
36.7500	24.028	12.110	12.081	0.24	-0.00
36.7500	24.182	12.130	12.101	0.24	0.00
36.7400	26.087	12.410	12.357	0.43	0.01
36.7300	28.132	12.670	12.627	0.34	0.03
36.7200	30.145	12.900	12.880	0.16	0.03

D IN	T IN	CV IN	CV CAL	CV DIF	
36.7100	32.142	13.110	13.114	-0.03	0.03
36.7100	34.124	13.300	13.324	-0.18	0.05
36.7000	36.050	13.480	13.509	-0.21	0.03
36.6900	37.971	13.630	13.674	-0.32	0.01
36.6800	39.944	13.760	13.827	-0.49	-0.01
36.6700	41.916	13.870	13.969	-0.71	-0.02
36.6700	43.909	14.000	14.100	-0.72	-0.02
36.6600	45.923	14.120	14.224	-0.74	-0.03
36.6500	47.978	14.260	14.346	-0.60	-0.05
36.6400	50.029	14.390	14.468	-0.54	-0.06
36.6200	52.051	14.520	14.588	-0.47	-0.08
36.6200	54.085	14.670	14.717	-0.32	-0.08
37.8900	19.916	11.310	11.369	-0.53	0.01
37.8800	21.863	11.710	11.696	0.12	0.00
37.8700	22.377	11.800	11.778	0.18	-0.01
37.8700	23.924	12.060	12.023	0.31	0.02
37.8600	25.930	12.390	12.334	0.45	0.03
37.8500	28.037	12.670	12.645	0.20	0.03
37.8400	30.060	12.920	12.921	-0.01	0.03
37.8300	32.082	13.150	13.171	-0.16	0.03
37.8200	34.056	13.350	13.389	-0.29	0.01
37.8100	35.742	13.510	13.557	-0.35	-0.01
37.8000	37.538	13.650	13.714	-0.47	-0.03
37.7700	43.923	14.080	14.175	-0.67	-0.07
37.9100	16.139	10.320	10.065	2.47	0.05
37.9000	18.404	10.920	11.052	-1.21	0.00
37.8900	20.481	11.460	11.468	-0.07	-0.01
37.8800	22.038	11.740	11.724	0.14	-0.01
37.8700	24.088	12.090	12.049	0.34	-0.00
37.8600	26.136	12.410	12.365	0.36	0.01
37.8500	28.160	12.680	12.663	0.14	0.02
37.8500	30.196	12.920	12.939	-0.15	0.04
37.8400	32.239	13.160	13.190	-0.23	0.04
37.8300	34.255	13.370	13.410	-0.30	0.02
37.8200	35.982	13.520	13.578	-0.43	-0.00
37.8100	37.951	13.690	13.749	-0.43	-0.02
37.8000	39.930	13.820	13.904	-0.61	-0.05
37.8000	41.911	13.950	14.045	-0.68	-0.04
37.7900	43.900	14.080	14.175	-0.67	-0.06
37.7800	45.902	14.220	14.296	-0.53	-0.08
37.7700	47.938	14.350	14.415	-0.45	-0.09
37.7600	49.992	14.490	14.534	-0.31	-0.09
39.3700	18.021	10.730	10.742	-0.11	-0.02
39.3600	20.048	11.230	11.220	0.09	-0.01
39.3500	21.999	11.660	11.617	0.37	0.00
39.3400	23.985	12.020	11.937	0.19	0.01
39.3300	25.963	12.360	12.350	0.08	0.02
39.3200	27.931	12.640	12.672	-0.25	0.02
39.3100	29.909	12.900	12.962	-0.48	0.01
39.3000	31.907	13.140	13.223	-0.63	-0.00

D IN	T IN	CV IN	CV CAL	CV DIF	
39.2900	33.907	13.360	13.451	-0.68	-0.02
39.2800	35.894	13.560	13.649	-0.66	-0.04
39.2700	37.971	13.740	13.830	-0.66	-0.06
39.2600	39.935	13.880	13.982	-0.74	-0.08
39.2500	41.897	14.020	14.120	-0.71	-0.10
39.2400	43.899	14.160	14.248	-0.62	-0.11
39.2300	45.915	14.310	14.368	-0.41	-0.13
41.8100	21.991	11.520	11.563	-0.37	-0.02
41.8000	23.917	11.910	12.001	-0.77	-0.00
41.7900	25.987	12.290	12.411	-0.98	0.01
41.7800	28.055	12.620	12.765	-1.15	0.00
41.7700	30.055	12.910	13.061	-1.17	-0.01
41.7600	32.046	13.180	13.318	-1.05	-0.02
41.7500	33.990	13.410	13.535	-0.93	-0.04

1.4000+001	-1.8021+000	-1.8019+000	-1.8637-004	6.8915-002
1.5000+001	-1.2853+000	-1.2856+000	3.0744-004	1.1046-001
1.6000+001	-7.6273-001	-7.6349-001	7.6378-004	1.6766-001
1.7000+001	-2.3542-001	-2.3647-001	1.0459-003	2.4352-001
1.8000+001	2.9591-001	2.9480-001	1.1081-003	3.4125-001
1.9000+001	8.3072-001	8.2977-001	9.5735-004	4.6431-001
2.0000+001	1.3686+000	1.3680+000	6.3221-004	6.1647-001
2.1000+001	1.9092+000	1.9090+000	1.8859-004	8.0198-001
2.2000+001	2.4522+000	2.4526+000	-3.0923-004	1.0257+000
2.3000+001	2.9975+000	2.9983+000	-7.9579-004	1.2932+000
2.4000+001	3.5447+000	3.5459+000	-1.2109-003	1.6115+000
2.5000+001	4.0938+000	4.0953+000	-1.5054-003	1.9892+000
2.6000+001	4.6445+000	4.6461+000	-1.6480-003	2.4375+000
2.7000+001	5.1967+000	5.1983+000	-1.6302-003	2.9718+000
2.8000+001	5.7504+000	5.7519+000	-1.4717-003	3.6147+000
2.9000+001	6.3054+000	6.3066+000	-1.2209-003	4.4007+000
3.0000+001	6.8618+000	6.8627+000	-9.4743-004	5.3898+000
3.1000+001	7.4194+000	7.4201+000	-7.1197-004	6.7027+000
3.2000+001	7.9784+000	7.9789+000	-4.7823-004	8.6699+000

Appendix B. Table of Symbols

A = parameters for equation 1

B = parameters for vapor pressure equation

G = parameters for equation for saturation densities

N = parameters for equation of state

n = index of refraction

P = pressure

R = gas constant

r = parameters for index of refraction equation

T = temperature

x = reduced temperature

β = scaling law parameter

ρ = density

Subscripts:

c = critical point

g = gaseous phase

ℓ = liquid phase

t = triple point

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

A 32 term modified Benedict-Webb-Rubin equation of state has been applied to data for parahydrogen. The adjustable parameters in the equation of state were determined using data from the triple point to 2500 K, with pressures to 680 atmospheres. Extensive modifications have been made to the previously accepted PVT surface for the saturated liquid and vapor phases in the near critical region. These modifications have been made on the basis of subsequent refractive index data and the application of scaling law equations. Comparisons between experimental and calculated data are given.

17. KEY WORDS (Alphabetical order, separated by semicolons)

Critical point; equation of state; hydrogen; index of refraction; PVT; saturation properties; scaling laws.

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