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Compilation of thermodynamic and elastic data of liquid mercury (l-Hg)

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Physical properties

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Table 1. Properties of pure mercury at 20°C and 101 325 Pa.

Quantity	Value and uncertainty ($k = 1$)	Reference
Density	$(13\,545.850 \pm 0.012)\ \text{kg m}^{-3}$	[13], sections 2.3, 3.1
Thermal expansion coefficient	$(1.812 \pm 0.005) \times 10^{-4}\ \text{K}^{-1}$	Section 3.1
Isothermal compressibility	$(4.02 \pm 0.04) \times 10^{-11}\ \text{Pa}^{-1}$	[13], section 3.2
Vapour pressure	$(0.170 \pm 0.003)\ \text{Pa}$	[14]
Molar heat capacity	$(27.98 \pm 0.10)\ \text{J mol}^{-1}\ \text{K}^{-1}$	[14]
Thermal conductivity	$(8.09 \pm 0.24)\ \text{W m}^{-1}\ \text{K}^{-1}$	[14]
Compression heating	$(0.028 \pm 0.001) \times 10^{-6}\ \text{K Pa}^{-1}$	Section 3.2
Molar mass	$(200.59 \pm 0.01)\ \text{g mol}^{-1}$	[14]
Dynamic viscosity	$(1.56 \pm 0.015) \times 10^{-3}\ \text{Pa s}$	[14]
Surface tension	$(485 \pm 2) \times 10^{-3}\ \text{N m}^{-1}$	[14]
Electrical conductivity	$(1.044 \pm 0.0035) \times 10^{6}\ \text{S m}^{-1}$	[14]

Density of mercury - measurements and reference values,
H.Bettin, H.Fehlauer, Metrologia **41** S16–S23 (2004)

Spetzler (1975)

Table 1. Selected equation-of-state parameters for mercury

P (GPa)	T	v	$\left(\frac{\partial v}{\partial T}\right)_P$	$\left(\frac{\partial v}{\partial P}\right)_T$	K_S	$\left(\frac{\partial K_S}{\partial T}\right)_P$	$\left(\frac{\partial K_S}{\partial P}\right)_T$	γ	α_S
Mercury									
0	300	1·450	−42·4	2·117	2·845	−2·18	9·68	2·74	1·813
	550	1·334	−50·6	2·79	2·299	−2·17	11·74	2·43	1·846
	750	1·227	−56·0	3·38	1·873	−2·09	13·57	2·23	2·031
	950	1·110	−60·4	4·04	1·468	−1·95	15·51	2·07	2·404
0·4	300	1·532	−35·1	1·91	3·222	−2·01	8·76	2·80	1·660
	550	1·436	−41·2	2·33	2·719	−2·00	10·16	2·49	1·619
	750	1·349	−45·1	2·76	2·323	−1·94	11·53	2·30	1·688
	950	1·256	47·9	3·27	1·943	−1·84	13·09	2·14	1·851
0·8	300	1·604	−30·9	1·72	3·582	−1·93	8·08	2·85	1·543
	550	1·521	−35·1	1·95	3·103	−1·89	8·77	2·53	1·465
	750	1·449	−37·3	2·21	2·732	−1·81	9·63	2·34	1·480
	950	1·373	−38·6	2·56	2·378	−1·71	10·73	2·20	1·556

Sound velocity and equation of state of liquid mercury and bismuth at simultaneous high P and T, H.A.Spetzler *et al* High Temp.-High Pressures **7** 481 (1975)

Phase diagram

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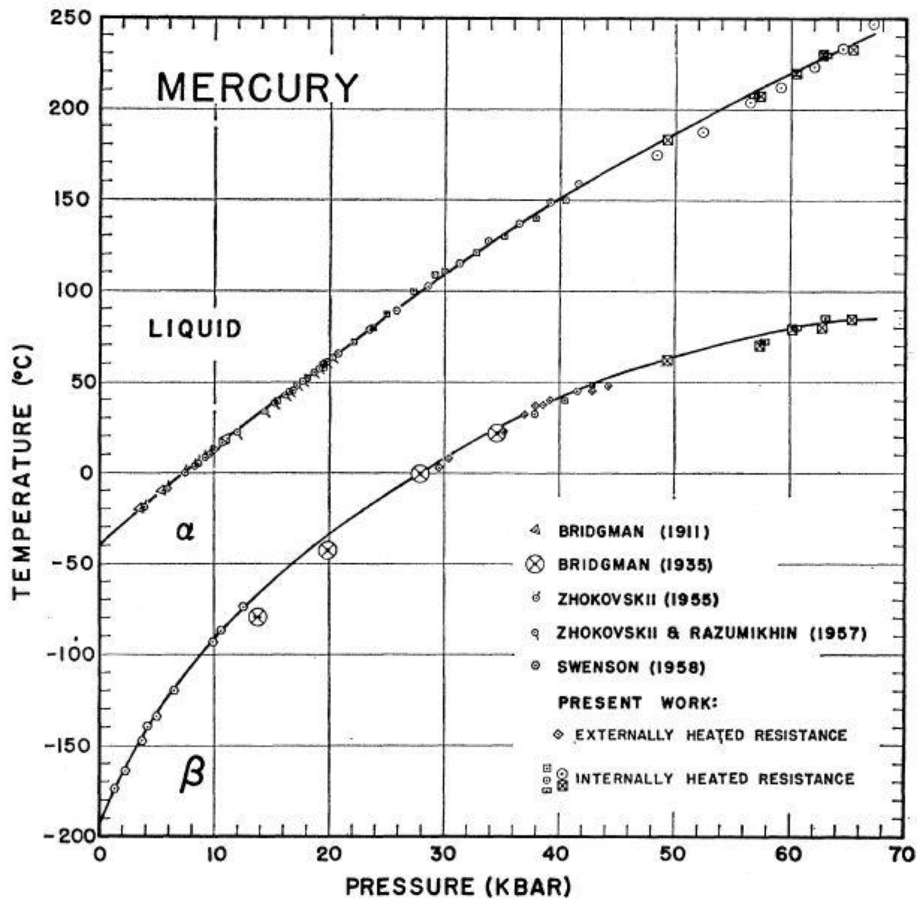


W. Klement, A. Jayaraman, and G. C. Kennedy, *Transformations in mercury at high pressures*, Phys. Rev. **131** 1 (1963)

Schulte (1993)

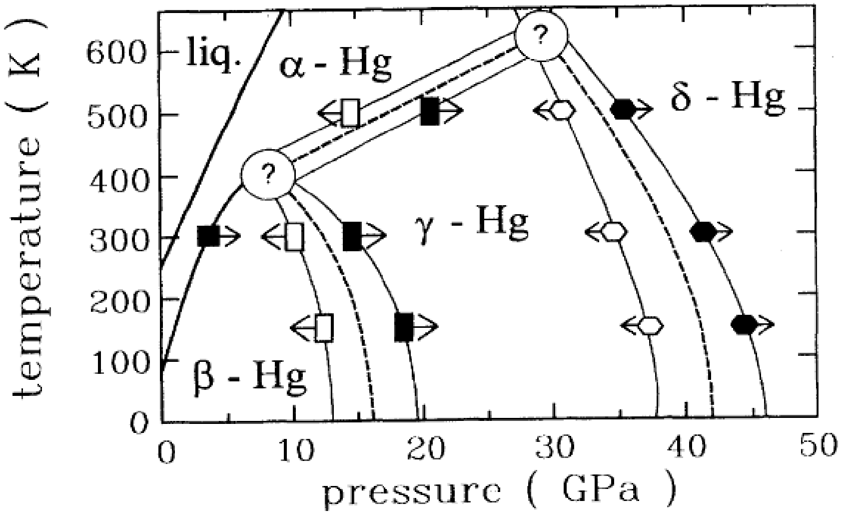
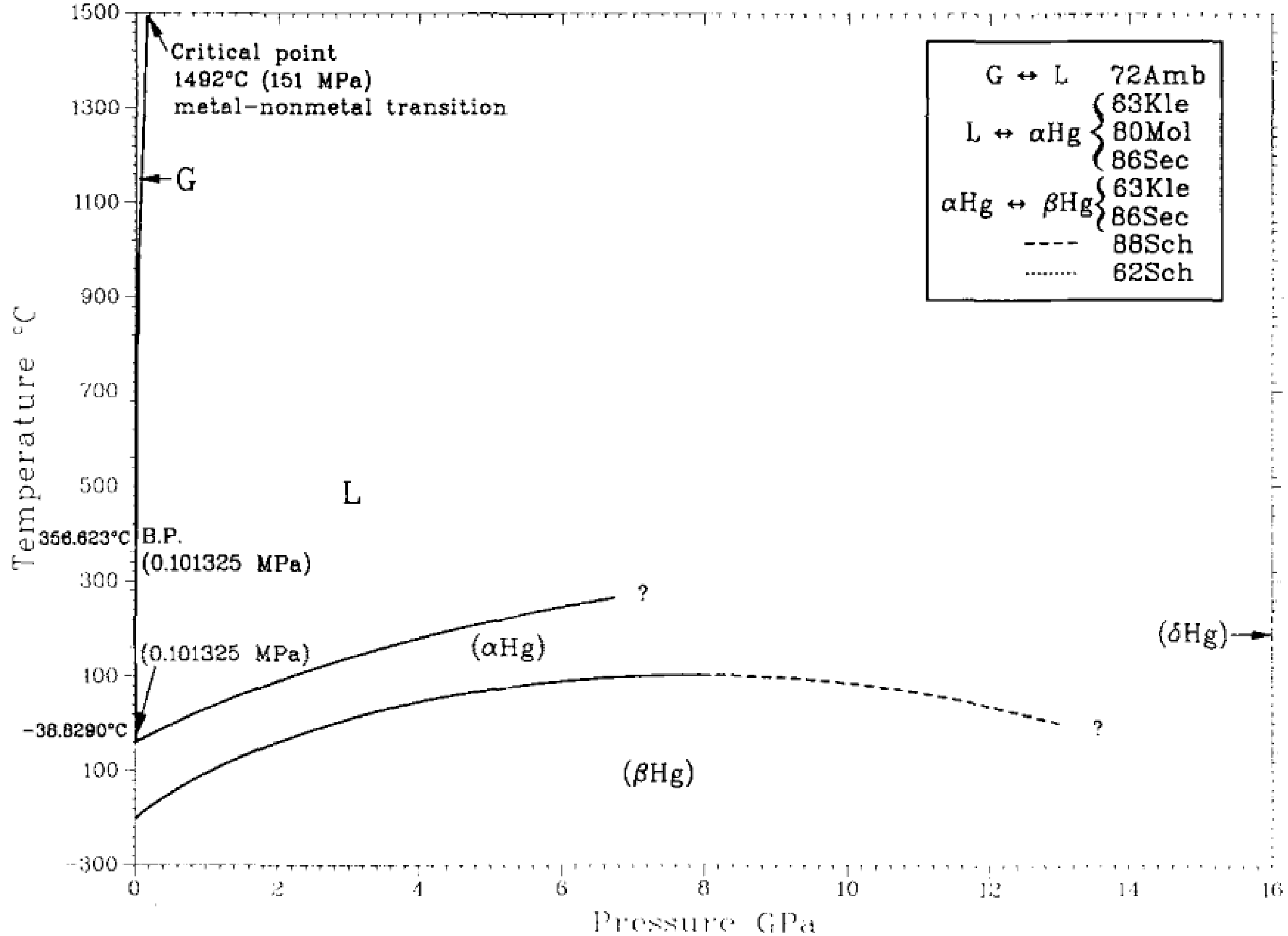


FIG. 2. Phase diagram of mercury. Closed and open symbols represent forward and backward transitions, respectively. The shaded areas show the regions of hysteresis and the question marks indicate roughly the locations of the triple points.

Phase diagram for mercury up to 67 GPa and 500 K,
O.Schulte, W.B.Holzapfel, Phys.Rev.B, **48** 14009 (1993)



The pressure dependence of the αHg melting process has been investigated quite intensively, and ~180 experimental points from [63Kle], [80Mol], and [86Sec] form the smooth line that is shown in Fig. 1. All these authors used precise DTA methods. For up to 1200 MPa, the data may be described by the equation of [80Mol]:

$$P = 19.32835\,(T + 38.8290) + 1.7068 \times 10^{-3}\,(T + 38.8290)^2 + 6.08670X \times 10^{-5}\,(T + 38.8290)^3$$

Guminski, *Journal of Phase Equilibria* **13** 657 (1992)

Adiabatic sound velocity

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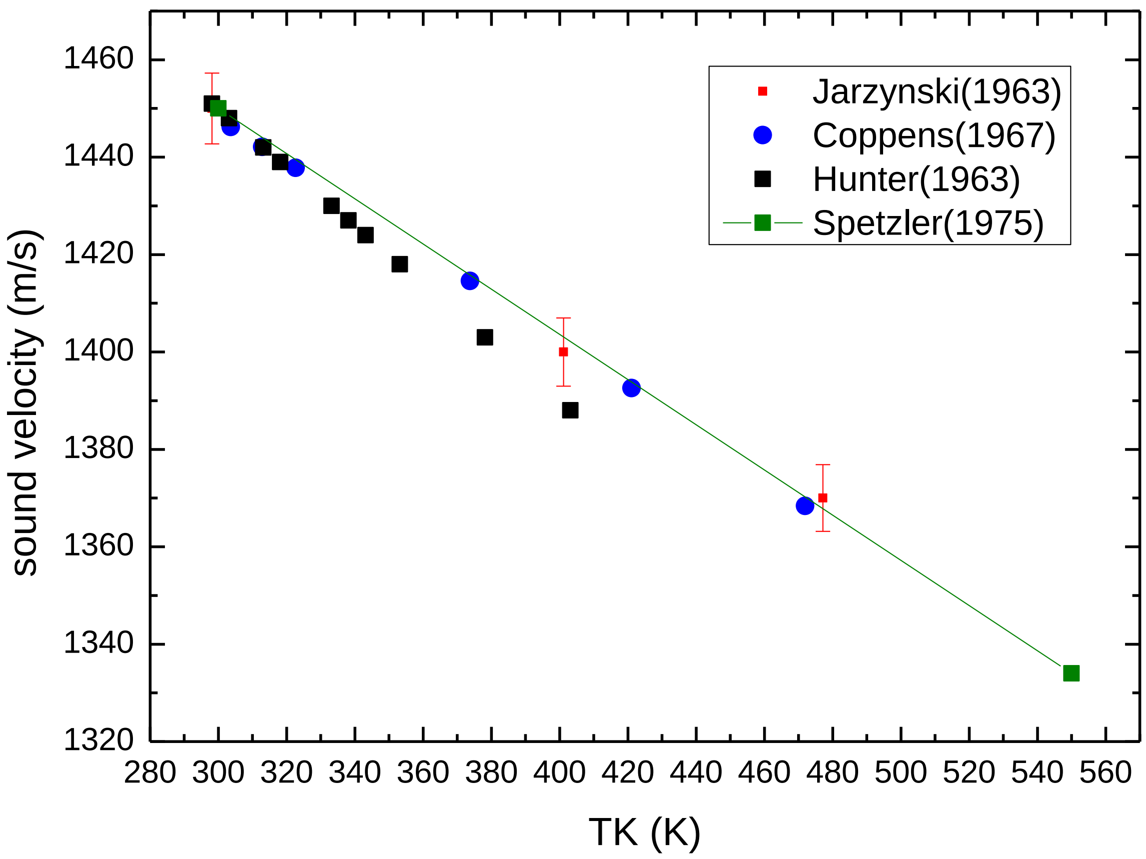
Sound velocity at ambient P ($P_{amb}=10^5$ Pa), as a function of T (298-500K)
→ data from Hunter (1963) shows a deviation from other authors



Jarzynski (1963)

(Table 1)

Mercury

(1)	(2)	(3)	(4)	(5)	(6)
25	6·2	4·26	0·98	1·9	1·2
128	9·0	7·33	0·84	1·6	1·4
204	11·8	10·15	0·83	1·3	1·3

(1) T (°c); (2) $\alpha_{obs}/f^2 \times 10^{17}$ ($sec^2\ cm^{-1}$); (3) $\alpha_T/f^2 \times 10^{17}$ ($sec^2\ cm^{-1}$); (4) $\alpha_S/f^2 \times 10^{17}$ ($sec^2\ cm^{-1}$); (5) η_B (centipoise); (6) η_B/η_S.

(Table 2)

Mercury

(1)	(2)	(3)	(4)	(5)	(6)	(7)
25	1·810(*f*)	1·45(*b*)	0·03319(*e*)	0·0200(*g*)	1·53(*i*)	13·534(*f*)
128	1·806	1·40	0·03266	0·0236(*h*)	1·17	13·285
204	1·819	1·37	0·03244	0·0257	1·05	13·103

(1) T (°c); (2) $\beta \times 10^4$ ($degc^{-1}$); (3) $c \times 10^{-5}$ ($cm\ sec^{-1}$); (4) c_P ($cal\ g^{-1}\ degc^{-1}$); (5) K ($cal\ sec^{-1}\ degc^{-1}\ cm^{-1}$); (6) η_S (centipoise); (7) ρ ($g\ cm^{-3}$).

(*a*) Strauss and Richards 1962; (*b*) present investigation; (*c*) Kelley 1949; (*d*) Powell and Tye 1958; (*e*) *Liquid Metals Handbook* 1952; (*f*) Beattie *et al.* 1941; (*g*) *Handbook of Chemistry and Physics* 1959; (*h*) Ewing *et al.* 1955; (*i*) Erk 1928.

« The absorption and velocity were measured at 68 Mc/s and 92 Mc/s. The velocity and alpha α/f^2 were found to be independent of frequency. Successive measurements of α/f^2 at the same temperature were reproducible to within 5%. Each value of α/f^2 given in table 1 is the average of several absorption measurements, and is estimated to be accurate to ± 2%. The velocity values are estimated to be accurate to ±0.5%. »

Jarzynski, J. (1963). Ultrasonic propagation in liquid Bismuth and Mercury. *Proceedings of the Physical Society*, *81*(4), 745.

Hill & Ruoff (1965)

TABLE I. Least-squares equations, slope, and standard deviations, and temperature ranges for velocity of sound measurements.

System	Least-squares equation (m/sec)	Slope and standard deviation (m/sec)	Temperature range (°C)
In	$v=2310.7-0.296$ (T°C-167)	0.296 ± 0.001	167–345
Hg	$v=1447.4-0.473$ (T°C-30)	0.473 ± 0.002	30–197
Pb–73.9-at.% Sn	$v=2264.1-0.254$ (T°C-185)	0.254 ± 0.002	185–345

Coppens (1967)

TABLE II. Speed of sound in mercury in meters per second.[a]

T (°C)	Pressure above atmospheric (psi) 0	750	1000	1500	2000
30.49	1446.22		1447.7		1449.2
39.70	1442.12		1443.6		1445.1
49.50	1437.8		1439.2		1440.8
100.56	1414.6	1415.8		1417.0	
147.92	1392.6				
149.25		1393.2		1394.4	
198.78	1368.4	1369.5			

[a] Estimated random error ±0.05 m/sec; estimated excess speed <0.15 m/sec.

Metal	Temperature (°C)	Speed of sound c (m/sec)	Observer
Hg	30	1448±2	Hunter *et al.*[a]
		1448±6	Jarzynski[b]
		1446.2	Hubbard and Loomis[c]
		1449±3	Golik *et al.*[d]
		1447.4	Hill and Ruoff[e]
		1446.4±0.2	Our research

Coppens, A. B., Beyer, R. T., & Ballou, J. (1967). Parameter of nonlinearity in fluids. III. values of sound velocity in liquid metals. *The Journal of the Acoustical Society of America*, *41*(6), 1443-1448.

Davis & Gordon (1967)

T=21.9°C		T=40.5°C		T=~~42.9~~°C 52.9°C	
Pressure	Velocity	Pressure	Velocity	Pressure	Velocity
1	1450.1	1	1441.5	1	1435.8
299	1457	516	1453	464	1447
584	1463	932	1463	925	1457
989	1472	1 458	1474	1 485	1469
1 276	1478	1 930	1484	1 942	1478
1 532	1483	2 144	1488	2 511	1490
2 106	1495	2 769	1500	2 537	1491
3 254	1517	3 080	1507	3 019	1500
3 264	1518	3 893	1522	4 232	1524
3 490	1522	4 298	1530	4 548	1530
4 565	1542	4 483	1533	4 942	1537
5 772	1564	5 539	1552	5 470	1546
5 907	1566	5 642	1555	6 885	1572
6 138	1570	6 518	1569	6 915	1573
7 542	1594	7 168	1581	7 746	1587
8 310	1606	7 175	1581	8 255	1595
8 858	1615	8 309	1599	9 533	1616
8 950	1616	8 538	1604	9 954	1623
9 894	1632	9 399	1618	10 939	1639
10 695	1644	10 318	1632	11 203	1642
10 926	1648	10 384	1634	11 503	1647
11 485	1656	11 830	1656	11 792	1651
11 532	1657	11 922	1657	12 968	1669
11 985	1664	12 315	1663	13 023	1670
12 035	1665	13 270	1677	13 332	1675
		13 709	1684		
		14 213	1691		
		14 695	1698		
		14 921	1701		

[a] Pressure in bars, velocity in meters per second.

$\Delta v/v = 0.04$ %

Davis, L. A., & Gordon, R. B. Compression of mercury at high pressure. *The journal of chemical physics*, *46*(7), 2650-2660 (1967)

Spetzler (1975)

P (GPa)	T	v	$\left(\frac{\partial v}{\partial T}\right)_P$	$\left(\frac{\partial v}{\partial P}\right)_T$	K_S	$\left(\frac{\partial K_S}{\partial T}\right)_P$	$\left(\frac{\partial K_S}{\partial P}\right)_T$	γ	α_S
Mercury									
0	300	1·450	−42·4	2·117	2·845	−2·18	9·68	2·74	1·813
	550	1·334	−50·6	2·79	2·299	−2·17	11·74	2·43	1·846
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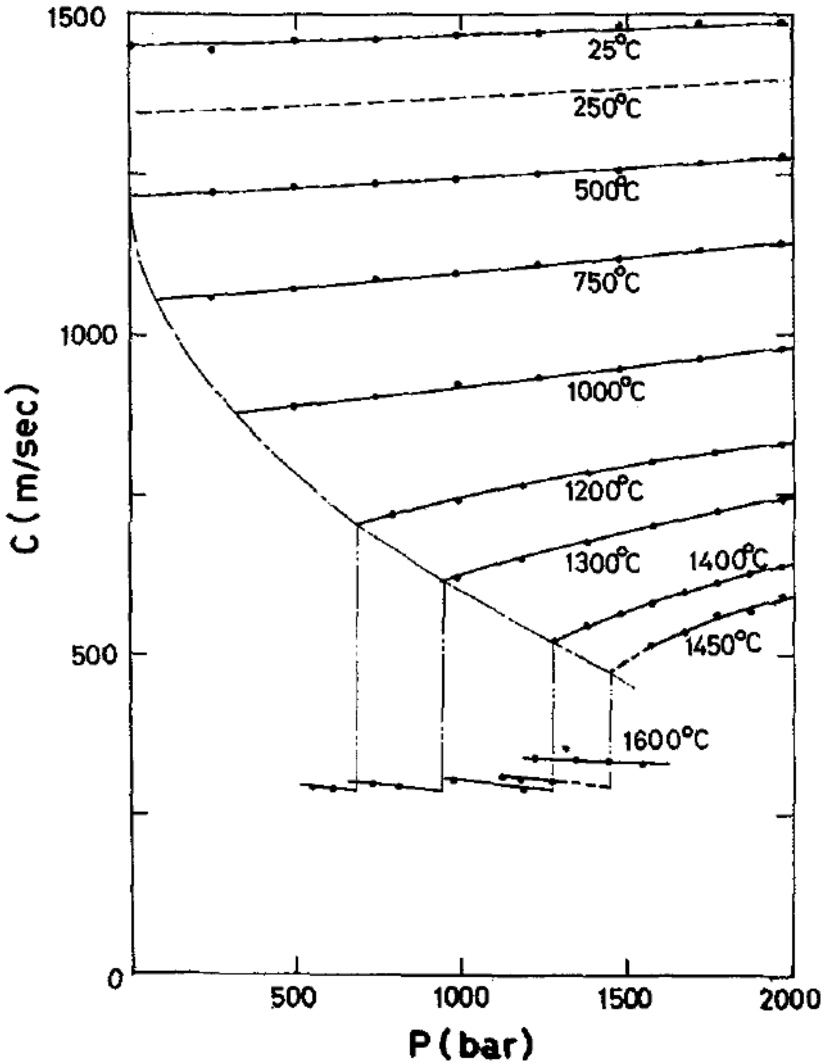
0·4	300	1·532	−35·1	1·91	3·222	−2·01	8·76	2·80	1·660
	550	1·436	−41·2	2·33	2·719	−2·00	10·16	2·49	1·619
	750	1·349	−45·1	2·76	2·323	−1·94	11·53	2·30	1·688
	950	1·256	47·9	3·27	1·943	−1·84	13·09	2·14	1·851
0·8	300	1·604	−30·9	1·72	3·582	−1·93	8·08	2·85	1·543
	550	1·521	−35·1	1·95	3·103	−1·89	8·77	2·53	1·465
	750	1·449	−37·3	2·21	2·732	−1·81	9·63	2·34	1·480
	950	1·373	−38·6	2·56	2·378	−1·71	10·73	2·20	1·556

Spetzler, H. A., Meyer, M. D., & Chan, T. Sound velocity and equation of state of liquid mercury and bismuth at simultaneous high pressure and temperature. *High Temperatures-High Pressures*, ***7***, 481-496 (1975)

Suzuki (1980)



« The experimental errors in the sound velocity and the temperature are within ±2% and ± 15%, respectively. »

Suzuki, K., Inutake, M., Fujiwaka, S., Yao, M., & Endo, H. SOUND VELOCITY AND THERMODYNAMIC PROPERTIES OF EXPANDED FLUID MERCURY, *Le Journal de Physique Colloques*, *41*(C8), C8-66. (1980)

Almond & Blairs (1980)

Table 1 Comparison of sound velocity in mercury at 293 K obtained here with measurements by other workers

	u (ms^{-1})
Hubbard and Loomis (1928)	(1451 ± 0·3)
Hill and Ruoff (1965b)	(1452·1 ± 0·1)
Hunter *et al* (1963)	(1454 ± 1·4)
Jarzynski (1963)	(1452·4 ± 7·0)
Kleppa (1949)	(1461 ± 15·0)
This work	(1452·4 ± 0·1)

D.P.Almond and S.Blairs *J. Phys. E: Sci. Instrum.* **13** 964 (1980)
doi:10.1088/0022-3735/13/9/016

Tilford (1987)

Reference	Frequency MHz	c(23 °C) m/s	$\frac{1}{c}\left(\frac{\delta c}{\delta T}\right)_P$ 10^{-4} K^{-1}	$\frac{1}{c}\left(\frac{\delta}{\delta P}\right)_T$ 10^{-10} Pa^{-1}
13	0.5	1452.4 ±0.3	−3.20±0.02	
14	NA	1459 ±1%	−4.8	
15	5	1450.7 ±0.47	−3.26±0.014	
16	4	1450.22 ±0.30	−3,16±0.028	
17[a]	5		−3.026	1.44
18	5	1449.5 ±0.2	−3.08	1.49
19	10−60	1452	−2.92±1−2%	1.46±1−2%
20	50	1451.0 ±0.01%		
present work	10	1449.461±10 ppm	−3.032±0.07%	1.42±9%

Metrologia 24, 121 - 131 (1987) **The Speed of Sound in a Mercury Ultrasonic Interferometer Manometer, C. R. Tilford**

Kohno (1999)

Table 1. Sound velocity, v, and sound attenuation coefficient, α, of Hg

Density [g cm^{-3}]	Temperature [°C]	Pressure [MPa]	v [m s^{-1}]	α [cm^{-1}]
5.0	1500	175.2	363 ± 11	18.4 ± 2.0
5.0	1513	180.5	367 ± 11	12.4 ± 1.3
5.0	1540	191.0	372 ± 11	8.17 ± 1.0
5.0	1555	196.5	378 ± 11	7.83 ± 0.9
6.0	1497	176.8	372 ± 11	79.2 ± 13.1
6.0	1506	181.2	376 ± 11	62.0 ± 9.9
6.0	1529	192.5	382 ± 11	25.7 ± 3.4
6.0	1540	198.3	389 ± 12	21.7 ± 2.5
7.0	1493	177.3	386 ± 12	46.5 ± 7.2
7.0	1501	182.3	392 ± 12	28.3 ± 4.7
7.0	1519	193.4	401 ± 12	18.3 ± 2.0
7.0	1530	199.8	414 ± 12	15.0 ± 1.6
8.0	1479	176.7	431 ± 13	15.6 ± 1.6
8.0	1488	183.5	436 ± 13	15.4 ± 1.6
8.0	1502	194.0	439 ± 13	14.2 ± 1.5
8.0	1512	201.0	443 ± 13	13.4 ± 1.4
9.0	1438	175.7	477 ± 14	12.0 ± 1.5
9.0	1448	184.0	479 ± 14	11.7 ± 1.4
9.0	1461	195.8	485 ± 15	11.6 ± 1.4
9.0	1470	203.7	488 ± 15	11.5 ± 1.4
10.0	1331	175.6	633 ± 19	5.80 ± 0.6
10.0	1343	187.8	636 ± 19	5.79 ± 0.6
10.0	1351	199.6	639 ± 19	5.65 ± 0.6
10.0	1362	205.6	641 ± 19	5.36 ± 0.6
11.0	1060	127.4	853 ± 26	2.53 ± 0.4
11.0	1087	164.7	874 ± 26	2.27 ± 0.4
11.0	1101	174.5	876 ± 26	2.26 ± 0.4
11.0	1117	201.8	881 ± 26	2.03 ± 0.4

Kohno, H., & Yao, M. (1999). Anomalous sound attenuation in the metal-nonmetal transition range of liquid mercury. *Journal of Physics: Condensed Matter*, *11*(28), 5399.

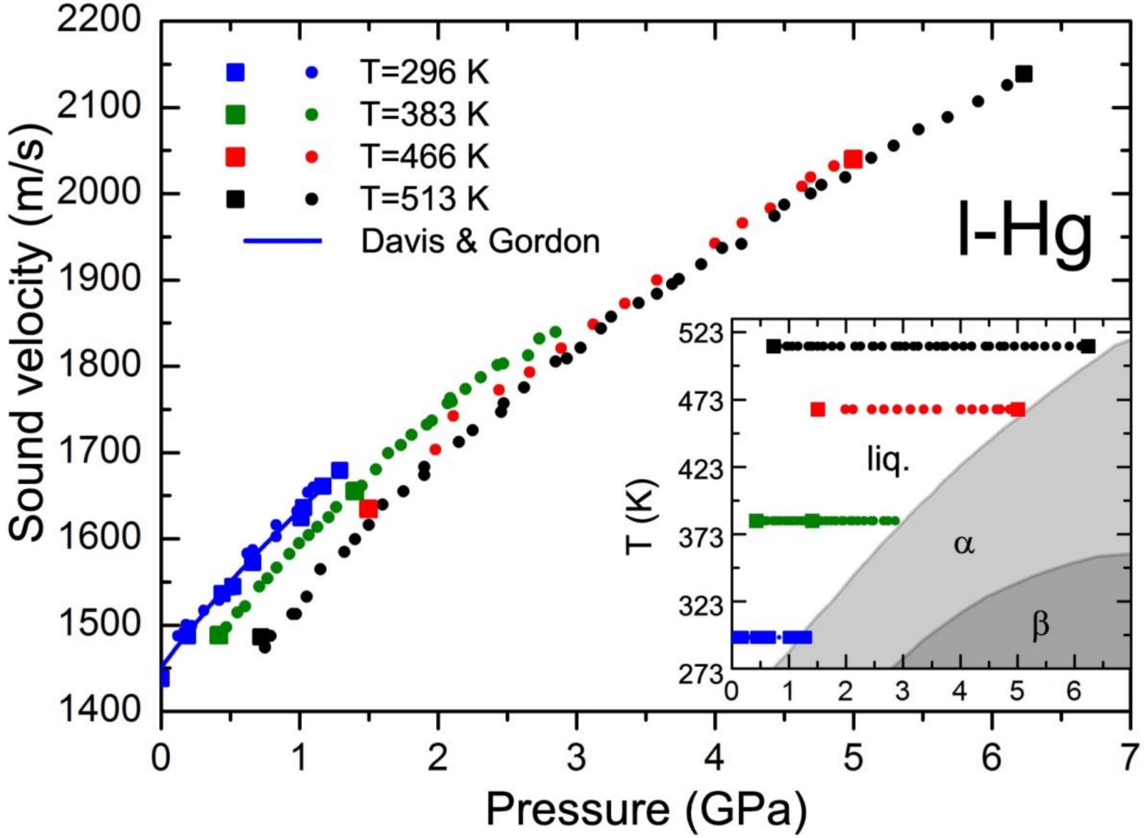
Kozhevnikov (1999)

TABLE AI. Sound velocity in mercury.

		Sound velocity (m/s) at pressures (MPa)									
T, K	P_{sat}, MPa	sat	30	60	80	100	120	140	160	170	190
550		1335	1342	1349	1354	1360	1363	1370	1374	1378	1382
600		1309	1316	1324	1329	1335	1340	1346	1350	1352	1358
650	0.1	1283	1291	1299	1304	1310	1316	1322	1326	1329	1335
700	0.3	1257	1265	1275	1280	1285	1291	1288	1303	1306	1311
750	0.6	1229	1238	1249	1254	1260	1267	1274	1280	1283	1287
800	1.0	1200	1211	1223	1229	1236	1243	1250	1257	1260	1263
850	1.9	1170	1183	1195	1202	1211	1218	1225	1233	1236	1239
900	3.0	1139	1153	1167	1175	1183	1191	1199	1208	1212	1215
950	4.6	1108	1122	1136	1146	1155	1163	1171	1181	1186	1189
1000	6.6	1075	1090	1105	1115	1125	1134	1143	1153	1159	1162
1050	9.4	1041	1055	1073	1084	1094	1104	1114	1124	1130	1134
1100	12.8	1006	1020	1039	1051	1062	1072	1082	1093	1099	1106
1150	17.1	970	982	1002	1016	1028	1038	1050	1061	1067	1076
1200	22.2	933	941	963	979	992	1003	1015	1027	1034	1044
1250	28.3	893	894	923	939	953	966	980	993	1000	1011
1300	35.3	854	285	879	897	913	927	944	957	965	977
1350	43.4	812	291	830	852	869	885	903	920	927	940
1400	52.6	768	296	777	802	822	842	860	878	887	901
1450	63.0	723	302	297	747	771	794	813	833	844	860
1500	74.7	676	307	303	686	714	741	763	786	797	813
1550	87.8	627	312	310	309	648	680	707	734	746	762
1600	102.7	577	317	317	315		610	644	675	689	709
1650	119.5	527		323	323	320	526	568	607	624	649
1700	138.7	476		329	329	328	326	475	528	547	580
1750	160.6	426		335	336	335	334	333		460	502
1800				341	342	342	342	342	342		420
1850				346	347	349	349	350	350	352	
1900				352	353	355	356	357	358	359	

A pulsed phase-sensitive technique for acoustical measurements
Vladimir F. Kozhevnikov, Dmitrii I. Arnold, Matthew E. Briggs, Salim P. Naurzakov, John M. Viner and P. Craig Taylor
J. Acoust. Soc. Am. **106**, 3424 (1999)

Ayrinhac (2014)



Equation of state of liquid mercury to 520 K and 7 GPa from acoustic velocity measurements

S. Ayrinhac, M. Gauthier, L. E. Bove, M. Morand, G. Le Marchand, F. Bergame, J. Philippe, and F. Decremps, J.Chem.Phys. **140**, 244201 (2014)

Sound attenuation

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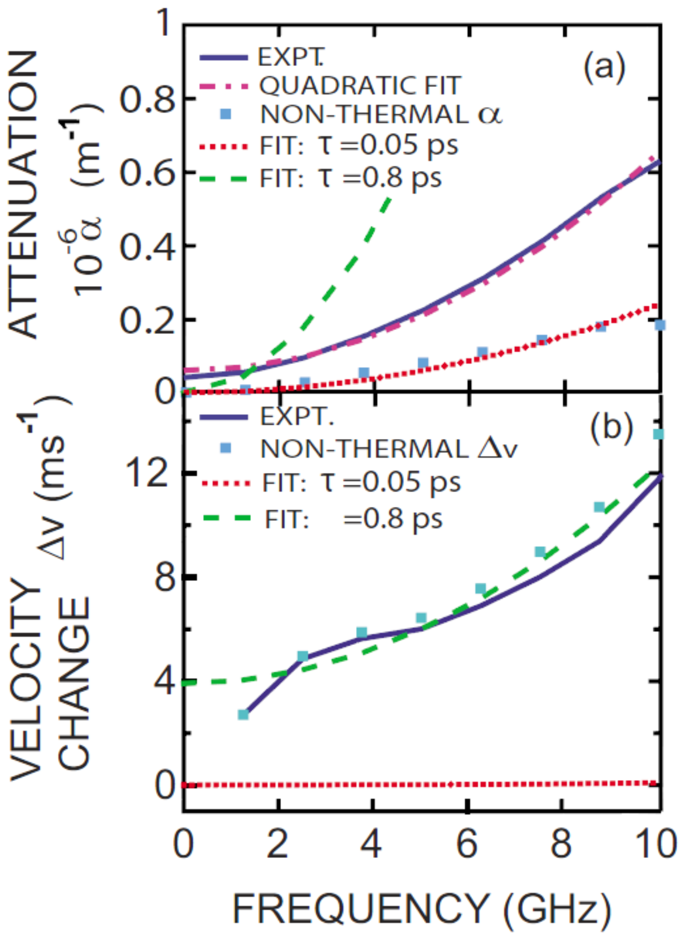
$\alpha(f) = A + Bf^2$
$B = 6000\ m^{-1}\ GHz^{-2}$,
$A = 85\ 000\ m^{-1}$,

$$1GHz \rightarrow \alpha = 0.1 \mu m^{-1}$$

$$10GHz \rightarrow \alpha = 0.6 \mu m^{-1}$$

O.Wright *et al*, *Optical excitation and detection of picosecond acoustic pulses in liquid mercury*, Phys.Rev.B **78**, 024303 (2008)

PHYSICAL REVIEW B **78**, 024303 (2008)



Hunter (1963)

TABLE I. Physical parameters of mercury used in computing α_{CL}/f^2.

T (°C)	ρ[a] (g/cm³)	η_s[b] (centipoise)	c[c] (msec)	K[d] (cal/cm-°C)	β[a] (×10⁴)	C_p[e] (cal/g-°C)
25	13.53	1.53	1451	0.0204	1.817	0.03321
30	13.52	1.49	1448	0.0207	1.818	0.03318
40	13.49	1.45	1442	0.0214	1.819	0.03311
45	13.48	1.42	1439	0.0216	1.819	0.03308
60	13.44	1.35	1430	0.0224	1.820	0.03299
65	13.43	1.33	1427	0.0227	1.821	0.03296
70	13.42	1.31	1424	0.0229	1.821	0.03292
80	13.40	1.27	1418	0.0232	1.823	0.03288
105	13.34	1.22	1403	0.0239	1.826	0.03276
130	13.28	1.17	1388	0.0244	1.829	0.03265

[a] J. A. Beattie, B. E. Blaisdell, J. Kaye, H. T. Gerry, and C. A. Johnson, Proc. Am. Acad. Arts Sci. **74**, 371 (1941).
[b] S. Erk, Z. Physik **47**, 886 (1928).
[c] Present investigation.
[d] R. W. Powell and R. P. Tye, "International Developments in Heat Transfer" (American Society of Mechanical Engineers, New York, 1961), p. 856.
[e] T. B. Douglas, A. F. Ball, and D. C. Ginnings, J. Res. Natl. Bur. Std. (U.S.) **46**, 334 (1951).

Hunter, J. L., Welch, T. J., & Montrose, C. J. (1963). Excess absorption in mercury. *The Journal of the Acoustical Society of America*, *35*(10), 1568-1570.

Table VI

Sound Attenuation Measurements in Mercury at 298°K

Investigator and technique	f (Mc/sec)	Observed attenuation ($\alpha/f^2 \times 10^{17}$ cm^{-1} sec^2)
Bär (1937), light diffraction:	54	6.6
Reickmann (1939), radiation pressure:	21.5	6.3
	54.0	6.4
Ringo *et al.* (1947), continuous wave:	152	5.8 ± 0.5
	291	5.5 ± 0.5
	390	5.7 ± 0.5
	774	4.7 ± 1.0
	996	6.0 ± 1.0
Jarzynski (1963), pulse:	68	6.2 ± 0.3
	92	6.2 ± 0.3
Abowitz and Gordon (1962b), pulse:	45	5.4 ± 0.5
	65	5.4 ± 0.3
	75	5.5 ± 0.2
	115	5.3 ± 0.1
Hunter *et al.* (1962), pulse:	130	5.6
	270	5.4
Hunter *et al.* (1963), pulse:	90	5.71 ± 0.1
	150	5.72 ± 0.1
	270	5.67 ± 0.1
Webber (1965), pulse:	68	5.6 ± 0.3

Physical Acoustics V4B: Principles and Methods

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Density

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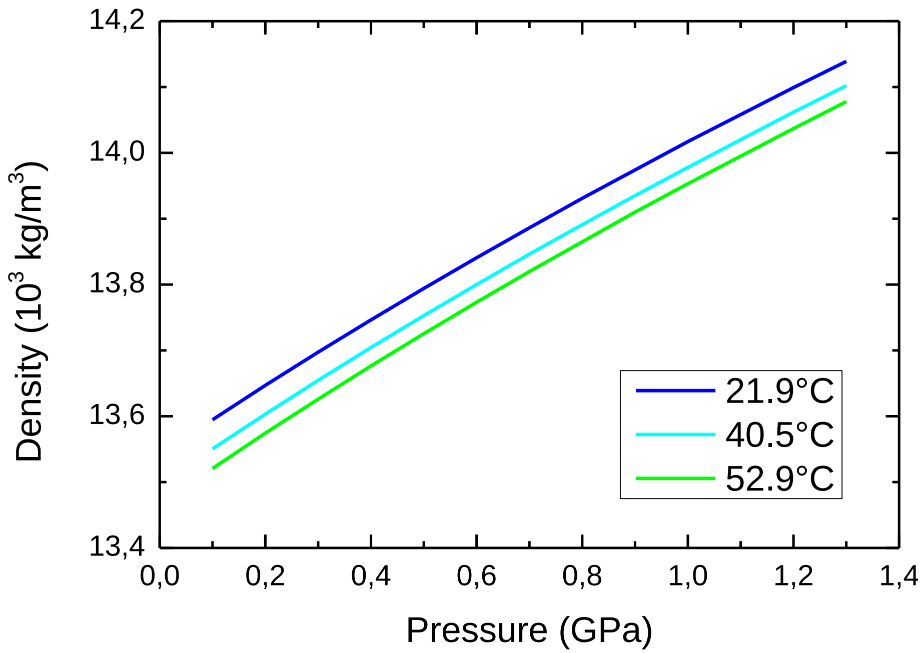
According to Bettin (2004), the reference value is :

ρ_0= 13545.859 kg/m^3
@ P= 101325 Pa
@ T= 20°C (293.15 K)

Density of mercury - measurements and reference values,
H.Bettin, H.Fehlauer, Metrologia **41** S16–S23 (2004)

Density from the work of Davis & Gordon (1967)
(Note : the curves start at P_0=1 kbar=0.1 GPa)

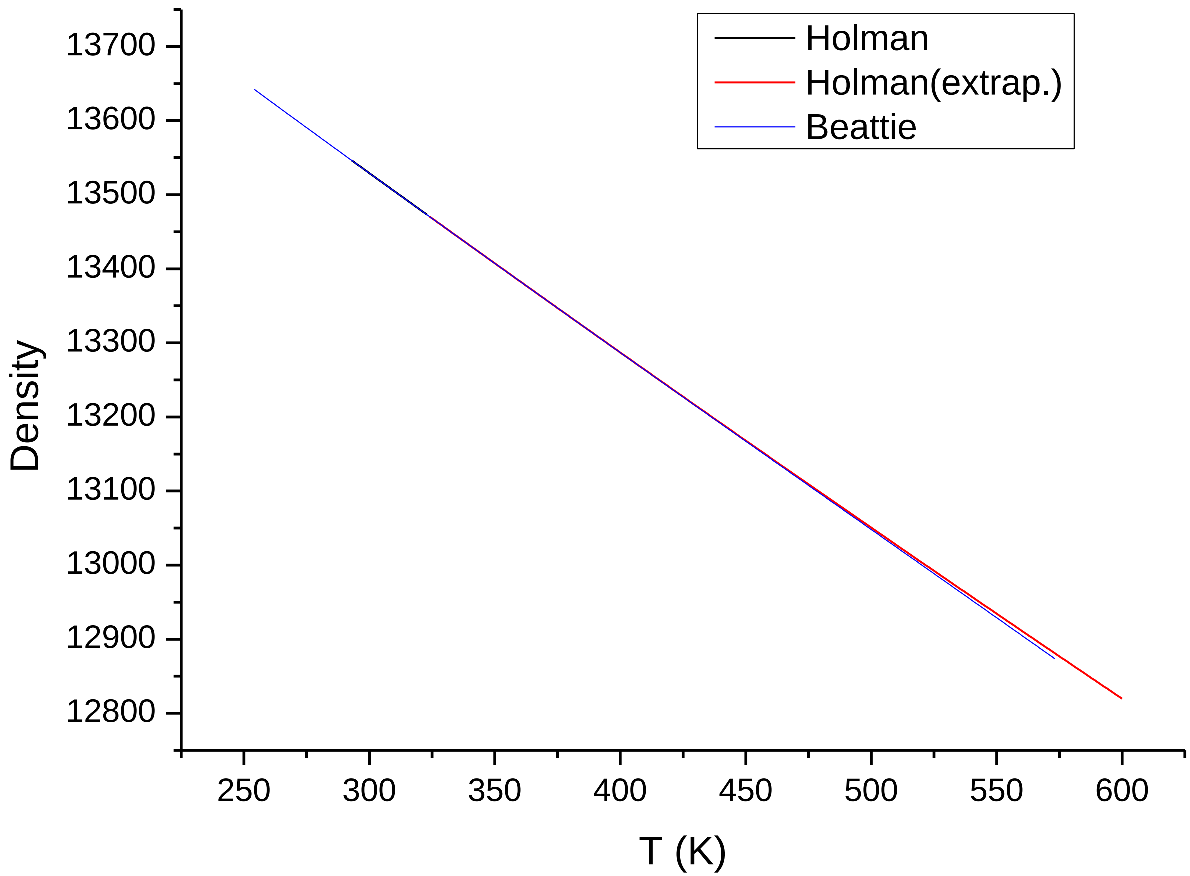


Davis, L. A., & Gordon, R. B. Compression of mercury at high pressure. *The Journal of Chemical Physics*, **46**, 2650-2660 (1967)

Polynomial representations of the density

Beattie : 13595.0828/(1+1.815868e-4*col(TC)+5.4583e-9*col(TC)^2+3.4980e-11*col(TC)^3+1.5558e-14*col(TC)^4)

Holman is limited to : 323.15 K ou 50°C, 300 MPa



Grindley (1971)

TABLE II. Density of mercury, g/cm³.

P, BARS	TEMPERATURE, C												
	30.00	40.00	50.00	60.00	70.00	80.00	90.00	100.00	110.00	120.00	130.00	140.00	150.00
0.	13.5213	13.4969	13.4725	13.4482	13.4239	13.3997	13.3755	13.3514	13.3273	13.3033	13.2792	13.2553	13.2314
1000.	13.5755	13.5526	13.5279	13.5053	13.4808	13.4572	13.4325	13.4103	13.3871	13.3634	13.3389	13.3157	13.2925
2000.	13.6286	13.6052	13.5818	13.5590	13.5356	13.5127	13.4887	13.4659	13.4433	13.4200	13.3969	13.3750	13.3516
3000.	13.6797	13.6577	13.6340	13.6121	13.5882	13.5656	13.5424	13.5206	13.4986	13.4745	13.4522	13.4306	13.4085
4000.	13.7302	13.7078	13.6846	13.6630	13.6404	13.6182	13.5948	13.5731	13.5515	13.5296	13.5071	13.4856	13.4627
5000.	13.7786	13.7569	13.7345	13.7127	13.6900	13.6683	13.6459	13.6247	13.6035	13.5813	13.5590	13.5381	13.5167
6000.	13.8272	13.8044	13.7819	13.7612	13.7393	13.7175	13.6948	13.6746	13.6530	13.6325	13.6105	13.5896	13.5679
7000.	13.8729	13.8516	13.8294	13.8084	13.7865	13.7653	13.7438	13.7231	13.7028	13.6811	13.6595	13.6402	13.6188
8000.	13.9181	13.8971	13.8749	13.8547	13.8335	13.8126	13.7906	13.7705	13.7501	13.7298	13.7078	13.6877	13.6675

Grindley, T., & Lind Jr, J. E., PVT properties of water and mercury. *The Journal of Chemical Physics*, **54** 3983-3989 (1971)

Holman (1994)

$$\rho_p^T = \Sigma_{i,j} C_{i,j}\, T^i\, p^j \qquad (28)$$

The recommended values for the density of mercury, calculated with Eq. (28), for temperatures between 293 and 323 K and applied pressures between zero and 300 MPa are given in Table 7.

TABLE 6. Density coefficients $C_{i,j}$ of Eq. (28)

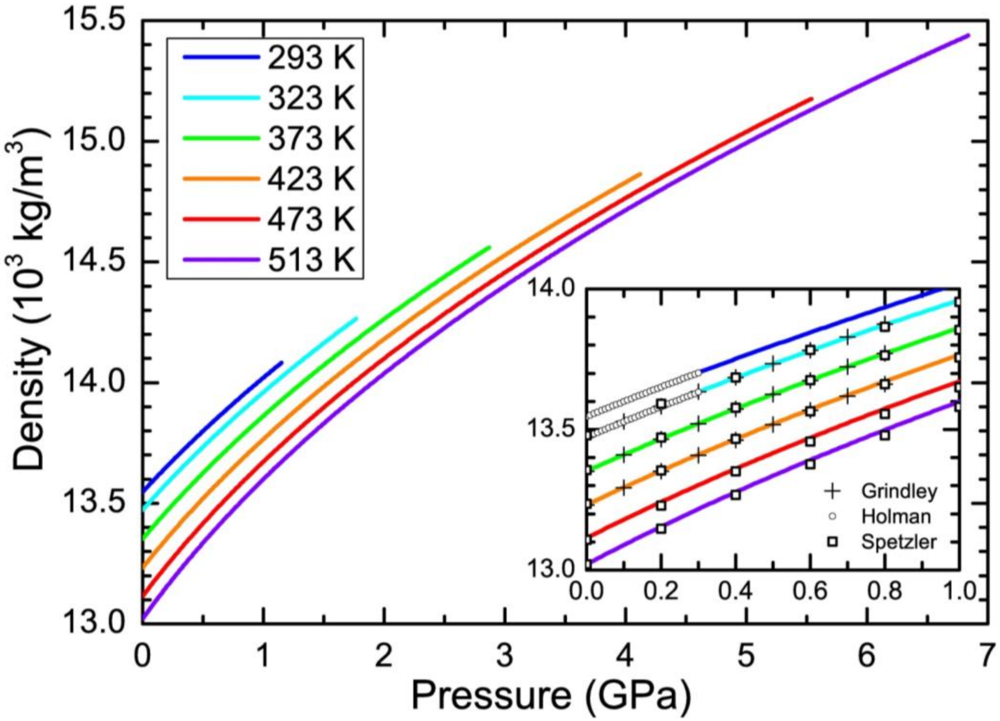
$i \backslash j$	0	1	2	3
0	14288.8433	0.3859641	-3.38435×10^{-5}	9.237×10^{-9}
1	−2.6164300	5.294163×10^{-4}	-1.61081×10^{-7}	
2	2.793555×10^{-4}			

TABLE 7. Density of mercury, kg/m^3

Applied pressure	Temperature K						
MPa	293.150	298.150	303.150	308.150	313.150	318.150	323.150
0	13545.84	13533.59	13521.35	13509.12	13496.90	13484.70	13472.52
50	13572.70	13560.57	13548.46	13536.36	13524.28	13512.21	13500.15
100	13599.16	13587.16	13575.17	13563.20	13551.24	13539.30	13527.37
150	13625.23	13613.35	13601.48	13589.64	13577.80	13565.98	13554.17
200	13650.91	13639.15	13627.40	13615.67	13603.96	13592.25	13580.56
250	13676.21	13664.57	13652.94	13641.32	13629.72	13618.13	13606.55
300	13701.15	13689.61	13678.09	13666.58	13655.09	13643.61	13632.15

Holman, G. J. F., & Ten Seldam, C. A. (1994). A critical evaluation of the thermophysical properties of mercury. *Journal of Physical and Chemical Reference Data*, *23*(5), 807-827.

Ayrinhac (2014)



Equation of state of liquid mercury to 520 K and 7 GPa from acoustic velocity measurements

S. Ayrinhac, M. Gauthier, L. E. Bove, M. Morand, G. Le Marchand, F. Bergame, J. Philippe, and F. Decremps, J.Chem.Phys. (2014)

Thermal expansion coefficient

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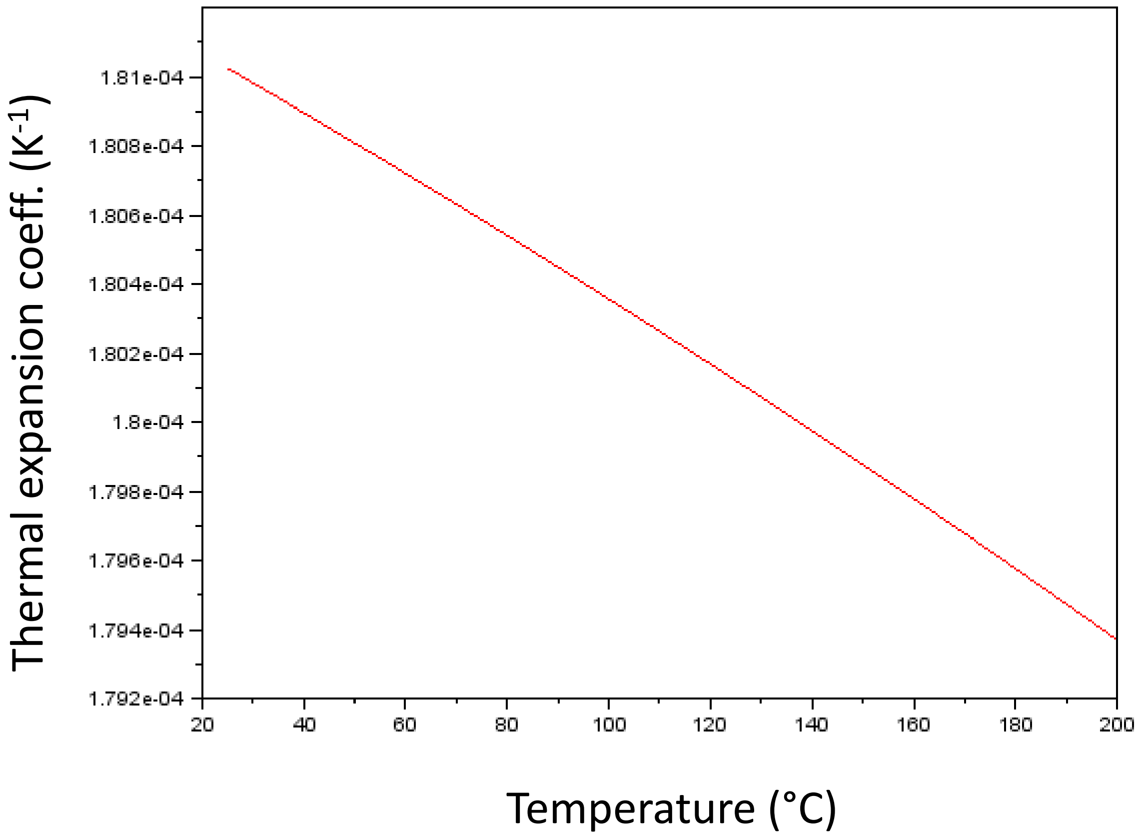
Calculated from density measurements $$\alpha_P \equiv -\frac{1}{\rho}\left(\frac{\partial \rho}{\partial T}\right)_P$$



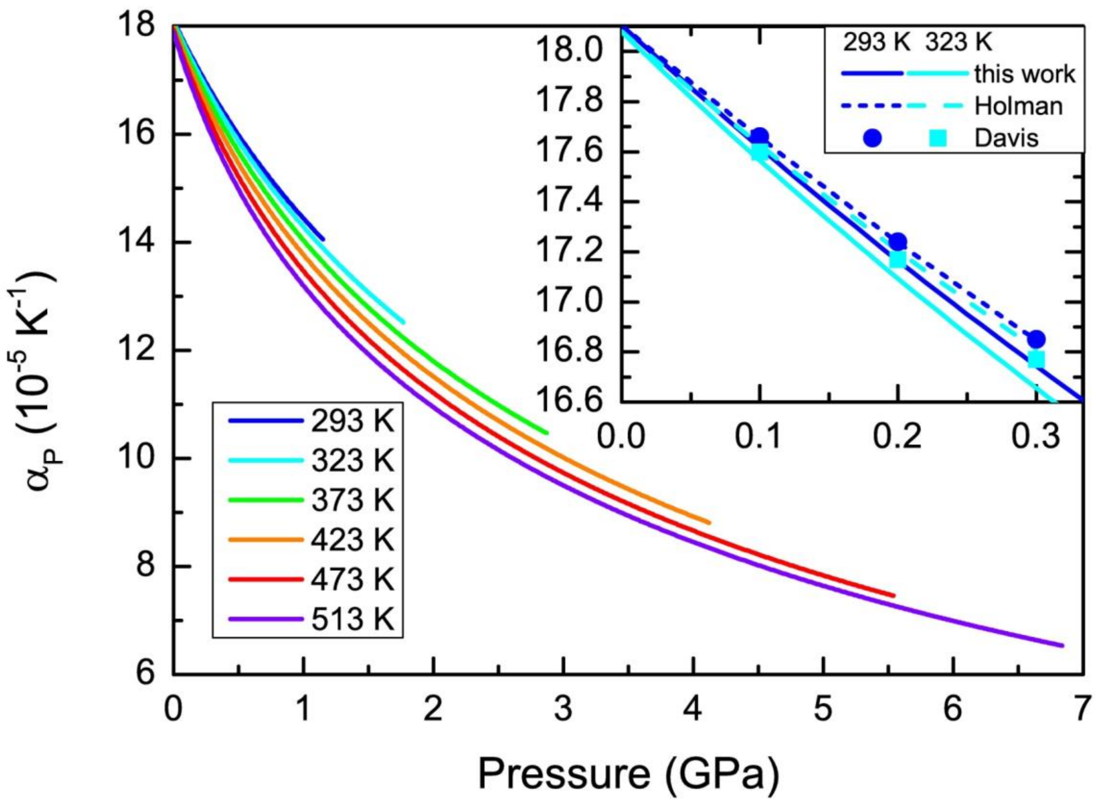
Grindley (1971)

Data calculated from density measurements

T(°C)/P(bars)	30	40	50	60	70	80	90	100	110	120	130	140	150
0	1.80456	1.80782	1.80739	1.80693	1.80648	1.80601	1.80554	2.02975	1.80538	1.58231	1.80734	1.80305	1.80631
1000	1.68686	1.75612	1.74824	1.74376	1.78402	1.79458	1.74577	1.69273	1.75169	1.80343	1.788	1.7423	1.74535
2000	1.71698	1.71993	1.70081	1.70367	1.7103	1.7354	1.73479	1.68574	1.70717	1.72876	1.67949	1.69346	1.7526
3000	1.60822	1.67305	1.67229	1.68233	1.71104	1.68809	1.66145	1.61975	1.70758	1.72177	1.6317	1.62688	1.64821
4000	1.63144	1.66329	1.63688	1.61751	1.64218	1.67423	1.65872	1.59507	1.91639	1.64187	1.31634	1.6462	1.701
5000	1.57491	1.60283	1.60909	1.62258	1.62162	1.61322	1.59755	1.556	1.59518	1.63828	1.59304	1.56226	1.58323
6000	1.64892	1.64078	1.56727	1.54783	1.59033	1.62202	1.56629	1.52838	1.54179	1.55878	1.57599	1.56738	1.59936
7000	1.53537	1.57022	1.56189	1.5534	1.56312	1.551	1.53524	1.49383	1.53253	1.58248	1.49713	1.49191	1.57136
8000	1.50883	1.55428	1.52794	1.49408	1.52167	1.55293	1.5264	1.47053	1.47999	1.54044	1.53562	1.6913	1.9178

T.Grindley, J.E.Lind Jr, PVT properties of water and mercury. *The Journal of Chemical Physics*, **54** 3983 (1971)

Ayrinhac (2014)



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S. Ayrinhac, M. Gauthier, L. E. Bove, M. Morand, G. Le Marchand, F. Bergame, J. Philippe, and F. Decremps, J.Chem.Phys. **140**, 244201 (2014)

Bulk modulus

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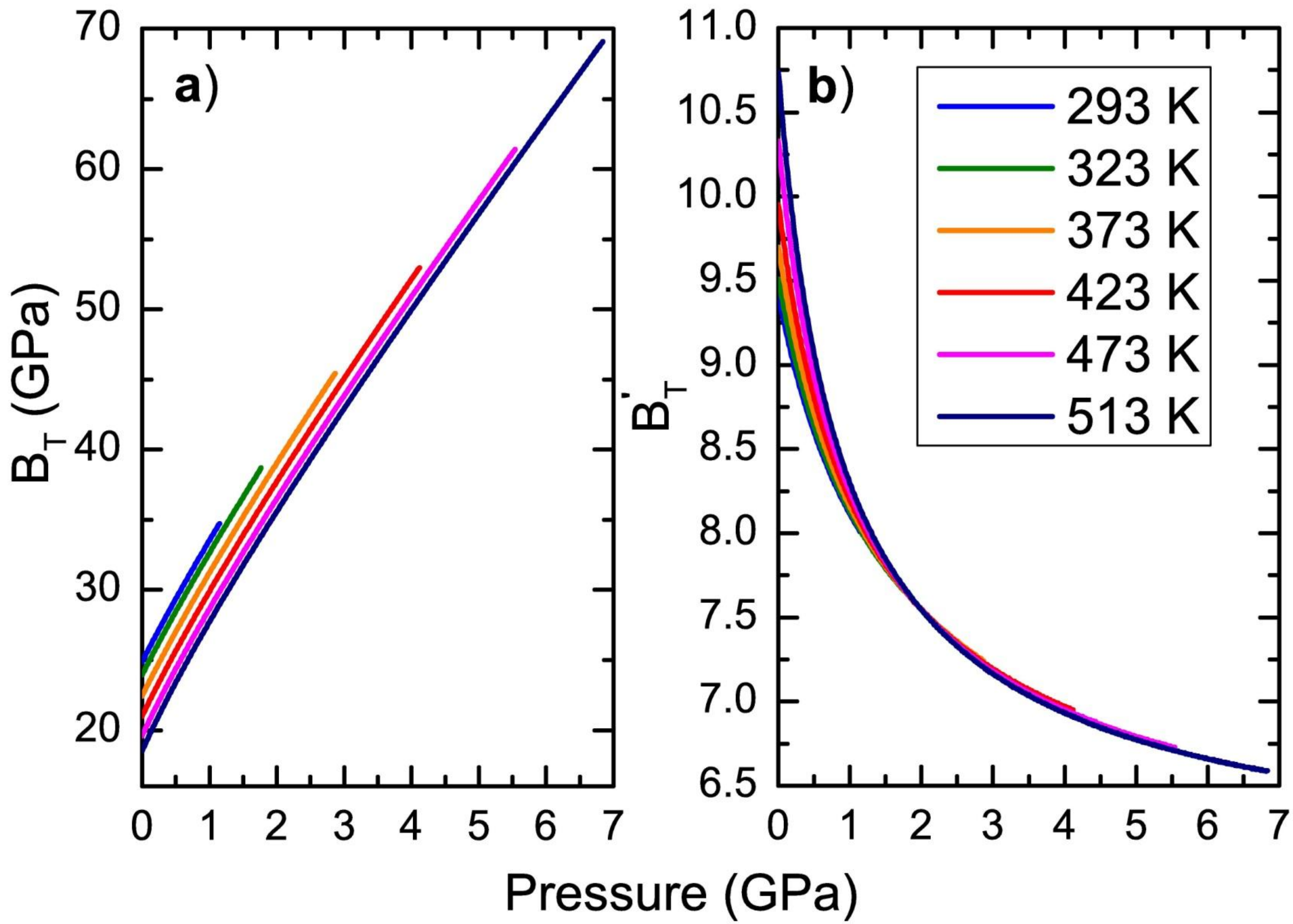

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Isobaric heat capacity C_P

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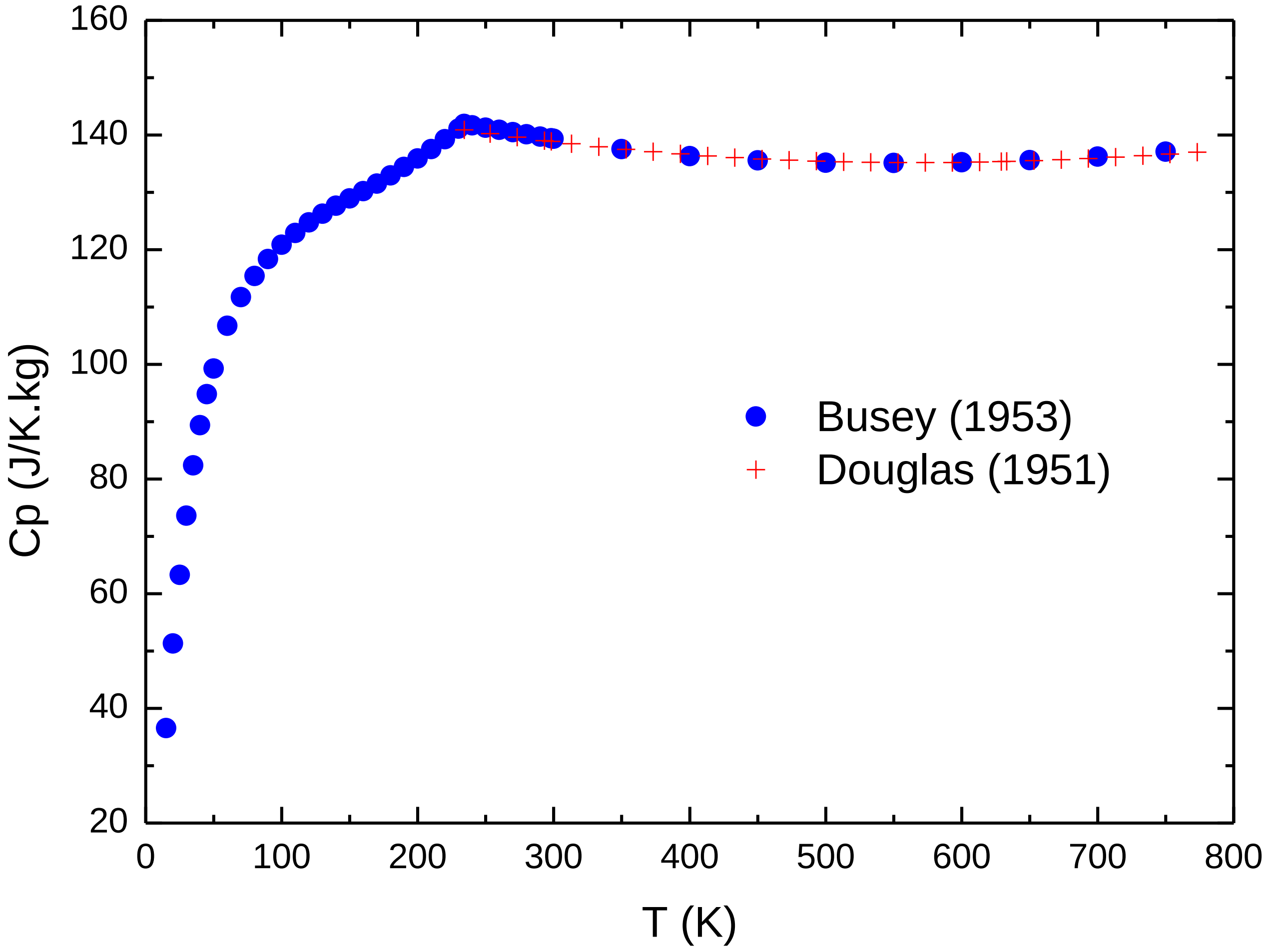
Hg molar mass : M=200.59 g/mol (CRC Handbook Lide, pages 6-179)



Busey, R. H., and W. F. Giauque. "The Heat Capacity of Mercury from 15 to 330° K. Thermodynamic Properties of Solid Liquid and Gas. Heat of Fusion and Vaporization1." *Journal of the American Chemical Society* 75.4 (1953): 806-809.

Douglas, T. B., A. F. Ball, and D. C. Ginnings. "HEAT CAPACITY OF LIQUID MERCURY BETWEEN 0 AND 450 C CALCULATION OF CERTAIN THERMODYNAMIC PROPERTIES OF THE SATURATED LIQUID AND VAPOR." *J. Research Natl. Bur. Standards* 46 (1951).

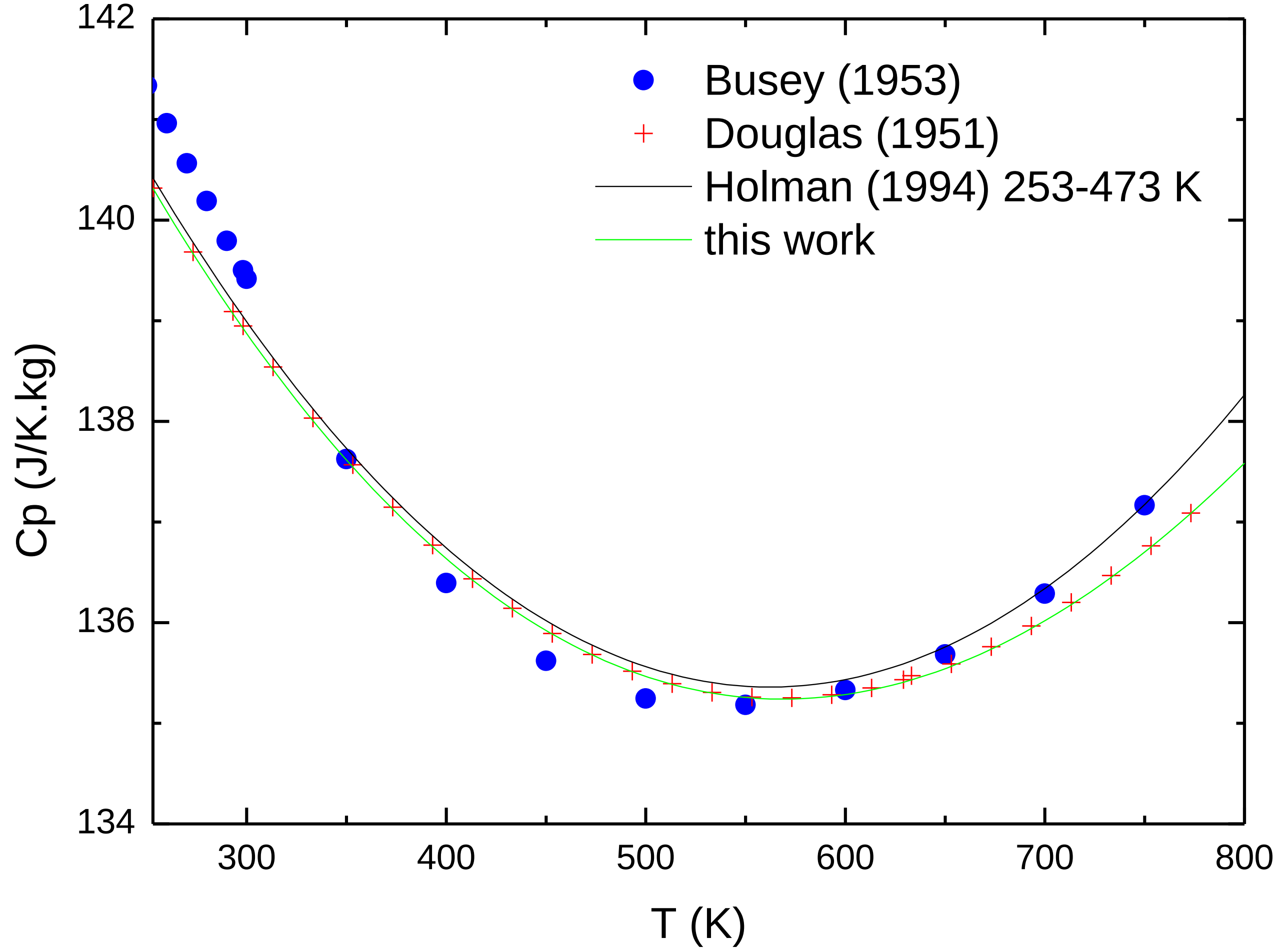
Heat capacity $C_P(T)$ above T=280 K

Holman (1994)

$C_P(T)=152.2958-0.0610935*T+5.66063e-5*T^2-2.704e-9*T^3$

New fit from this work (2014)

$C_P(T)= 152.77098-0.06585*T+6.89659e-5*T^2-1.29761e-8*T^3$



Douglas (1951)

TABLE 4. *Heat capacity*

Temperature	Heat capacity			
	Liquid			Vapor
	$C_{s(l)}$ (9)	$C_{p(l)}$ (11)	$C_{v(l)}$ (12)	$C_{p(g)}$ (29)
°C Int	*cal g-atom⁻¹ deg⁻¹*	*cal g-atom⁻¹ deg⁻¹*	*cal g-atom⁻¹ deg⁻¹*	*cal g-atom⁻¹ deg⁻¹*
−38.88[a] (tp)	6.7578	6.7578	5.969	4.968
−20	6.7272	6.7272	5.900	4.968
0	6.6967	6.6967	5.831	4.968
20	6.6683	6.6683	5.769	4.968
25	6.6615	6.6615	5.752	4.968
40	6.6419	6.6419	5.708	4.968
60	6.6176	6.6176	5.650	4.968
80	6.5954	6.5954	5.594	4.968
100	6.5752	6.5752	5.544	4.968
120	6.5571	6.5571	5.494	4.968
140	6.5410	6.5410	5.449	4.968
160	6.5270	6.5270	5.403	4.968
180	6.5150	6.5150	5.364	4.969
200	6.5050	6.5050	5.335	4.969
220	6.4970	6.4970	------------	4.970
240	6.4909	6.4910	------------	4.970
260	6.4867	6.4869	------------	4.971
280	6.4845	6.4847	------------	4.973
300	6.4840	6.4843	------------	4.975
320	6.4853	6.4858	------------	4.977
340	6.4884	6.4890	------------	4.980
356.58 (bp)	6.4922	6.4930	------------	4.983
360	6.4931	6.4940	------------	4.984
380	6.4993	6.5005	------------	4.988
400	6.5071	6.5087	------------	4.993
420	6.5164	6.5186	------------	4.999
440	6.5270	6.5298	------------	5.005
460	6.5390	6.5426	------------	5.013
480	6.5522	6.5567	------------	5.021
500	6.5666	6.5723	------------	5.030

[a] Triple point.

Thomas B. Douglas, Anne F. Ball, and Defoe C. Ginnings, Journal of Research of the Nationa l Bureau of Standards **46**(4), (1951)
Heat Capacity of Liquid Mercury Between 0° and 450°C; Calculation of Certain Thermodynamic Properties of the Saturated Liquid and Vapor

Thermal conductivity

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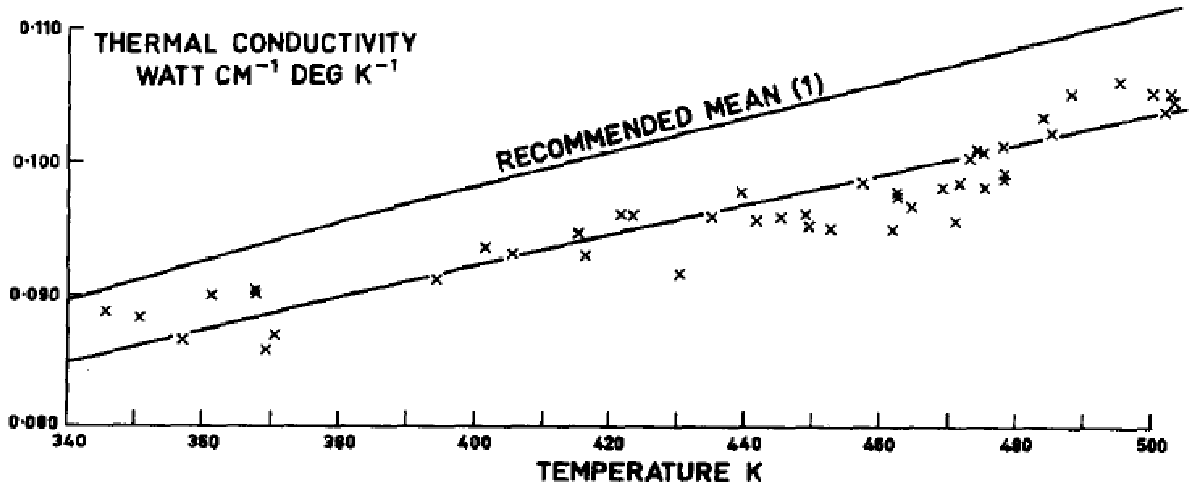

Fig. 1. Thermal conductivity of liquid mercury as a function of temperature - comparison between the mean of previous data [1] and the present results.

M.J.Duggin, *The thermal conductivity of liquid gallium,* Physics Letters A, **29** 470 (1969)