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D.U. Furrer and S.L. Semiatin, editors, p 599-601

Density of Metals and Alloys

Table 1 Density of metals and alloys

Metal or alloy	Density g/cm³	Density lb/in.³
Aluminum and aluminum alloys		
Aluminum (99.996%)	2.6989	0.0975
Wrought alloys		
EC, 1060 alloys	2.70	0.098
1100	2.71	0.098
2011	2.82	0.102
2014	2.80	0.101
2024	2.77	0.100
2218	2.81	0.101
3003	2.73	0.099
4032	2.69	0.097
5005	2.70	0.098
5050	2.69	0.097
5052	2.68	0.097
5056	2.64	0.095
5083	2.66	0.096
5086	2.65	0.096
5154	2.66	0.096
5357	2.70	0.098
5456	2.66	0.096
6061, 6063	2.70	0.098
6101, 6151	2.70	0.098
7075	2.80	0.101
7079	2.74	0.099
7178	2.82	0.102
Casting alloys		
A13	2.66	0.096
43	2.69	0.097
108, A108	2.79	0.101
A132	2.72	0.098
D132	2.76	0.100
F132	2.74	0.099
138	2.95	0.107
142	2.81	0.101
195, B195	2.81	0.101
214	2.65	0.096
220	2.57	0.093
319	2.79	0.101
355	2.71	0.098
356	2.68	0.097
360	2.64	0.095
380	2.71	0.098
750	2.88	0.104
40E	2.81	0.101
Copper and copper alloys		
Wrought coppers		
Pure copper	8.96	0.324
Electrolytic tough pitch copper (ETP)	8.89	0.321
Deoxidized copper, high residual phosphorus (DHP)	8.94	0.323
Free-machining copper		
0.5% Te	8.94	0.323
1.0% Pb	8.94	0.323
Wrought alloys		
Gilding, 95%	8.86	0.320
Commercial bronze, 90%	8.80	0.318
Jewelry bronze, 87.5%	8.78	0.317
Red brass, 85%	8.75	0.316
Low brass, 80%	8.67	0.313
Cartridge brass, 70%	8.53	0.308
Yellow brass	8.47	0.306
Muntz metal	8.39	0.303
Leaded commercial bronze	8.83	0.319
Low-leaded brass (tube)	8.50	0.307
Medium-leaded brass	8.47	0.306
High-leaded brass (tube)	8.53	0.308
High-leaded brass	8.50	0.307
Extra-high-leaded brass	8.50	0.307
Free-cutting brass	8.50	0.307
Leaded Muntz metal	8.41	0.304
Forging brass	8.44	0.305
Architectural bronze	8.47	0.306
Inhibited admiralty	8.53	0.308
Naval brass	8.41	0.304
Leaded naval brass	8.44	0.305
Manganese bronze (A)	8.36	0.302
Phosphor bronze, 5% (A)	8.86	0.320
Phosphor bronze, 8% (C)	8.80	0.318
Phosphor bronze, 10% (D)	8.78	0.317
Phosphor bronze, 1.25%	8.89	0.321
Free-cutting phosphor bronze	8.89	0.321
Cupro-nickel, 30%	8.94	0.323
Cupro-nickel, 10%	8.94	0.323
Nickel silver, 65-18	8.73	0.315
Nickel silver, 55-18	8.70	0.314
High-silicon bronze (A)	8.53	0.308
Low-silicon bronze (B)	8.75	0.316
Aluminum bronze, 5% Al	8.17	0.294
Aluminum bronze, (3)	7.78	0.281
Aluminum-silicon bronze	7.69	0.278
Aluminum bronze, (1)	7.58	0.274
Aluminum bronze, (2)	7.58	0.274
Beryllium copper	8.23	0.297
Casting alloys		
Chromium copper (1% Cr)	8.7	0.31
88Cu-10Sn-2Zn	8.7	0.31
88Cu-8Sn-4Zn	8.8	0.32
89Cu-11Sn	8.78	0.317
88Cu-6Sn-1.5Pb-4.5Zn	8.7	0.31
87Cu-8Sn-1Pb-4Zn	8.8	0.32
87Cu-10Sn-1Pb-2Zn	8.8	0.32
80Cu-10Sn-10Pb	8.95	0.323
83Cu-7Sn-7Pb-3Zn	8.93	0.322
85Cu-5Sn-9Pb-1Zn	8.87	0.320
78Cu-7Sn-15Pb	9.25	0.334
70Cu-5Sn-25Pb	9.30	0.336
85Cu-5Sn-5Pb-5Zn	8.80	0.318
83Cu-4Sn-6Pb-7Zn	8.6	0.31
81Cu-3Sn-7Pb-9Zn	8.7	0.31
76Cu-2.5Sn-6.5Pb-15Zn	8.77	0.317
72Cu-1Sn-3Pb-24Zn	8.50	0.307
67Cu-1Sn-3Pb-29Zn	8.45	0.305
61Cu-1Sn-1Pb-37Zn	8.40	0.304
Manganese bronze		
60 ksi	8.2	0.30
65 ksi	8.3	0.30
90 ksi	7.9	0.29
110 ksi	7.7	0.28
Aluminum bronze		
Alloy 9A	7.8	0.28
Alloy 9B	7.55	0.272
Alloy 9C	7.5	0.27
Alloy 9D	7.7	0.28
Nickel silver		
12% Ni	8.95	0.323
16% Ni	8.95	0.323
20% Ni	8.85	0.319
25% Ni	8.8	0.32
Silicon bronze	8.30	0.300
Silicon brass	8.30	0.300
Iron and iron alloys		
Pure iron	7.874	0.2845
Ingot iron	7.866	0.2842
Wrought iron	7.7	0.28
Gray cast iron	7.15(a)	0.258(a)
Malleable iron	7.27(b)	0.262(b)
0.06% C steel	7.871	0.2844
0.23% C steel	7.859	0.2839
0.435% C steel	7.844	0.2834
1.22% C steel	7.830	0.2829
Low-carbon chromium-molybdenum steels		
0.5% Mo steel	7.86	0.283
1Cr-0.5Mo steel	7.86	0.283
1.25Cr-0.5Mo steel	7.86	0.283
2.25Cr-1.0Mo steel	7.86	0.283
5Cr-0.5Mo steel	7.78	0.278
7Cr-0.5Mo steel	7.78	0.278
9Cr-1Mo steel	7.67	0.276
Medium-carbon alloy steels		
1Cr-0.35Mo-0.25 V steel	7.86	0.283
H11 die steel (5Cr-1.5Mo-0.4V)	7.79	0.281
Other iron-base alloys		
A-286	7.94	0.286
16-25-6 alloy	8.08	0.292
RA-330	8.03	0.290
Incoloy	8.02	0.290
Incoloy T	7.98	0.288
Incoloy 901	8.23	0.297
T1 tool steel	8.67	0.313
M2 tool steel	8.16	0.295
H41 tool steel	7.88	0.285
20W-4Cr-2V-12Co steel	8.89	0.321
Invar (36% Ni)	8.00	0.289
Hipernik (50% Ni)	8.25	0.298

(continued)

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Table 1 (continued)

Metal or alloy	Density g/cm³	Density lb/in.³
4% Si	7.6	0.27
10.27% Si	6.97	0.252
Stainless steels and heat-resistant alloys		
Corrosion-resistant steel castings		
CA-15	7.612	0.2750
CA-40	7.612	0.2750
CB-30	7.53	0.272
CC-50	7.53	0.272
CE-30	7.67	0.277
CF-8	7.75	0.280
CF-20	7.75	0.280
CF-8M, CF-12M	7.75	0.280
CF-8C	7.75	0.280
CF-16F	7.75	0.280
CH-20	7.72	0.279
CK-20	7.75	0.280
CN-7M	8.00	0.289
Heat-resistant alloy castings		
HA	7.72	0.279
HC	7.53	0.272
HD	7.58	0.274
HE	7.67	0.277
HF	7.75	0.280
HH	7.72	0.279
HI	7.72	0.279
HK	7.75	0.280
HL	7.72	0.279
HN	7.83	0.283
HT	7.92	0.286
HU	8.04	0.290
HW	8.14	0.294
HX	8.14	0.294
Wrought stainless and heat-resisting steels		
Type 301	7.9	0.29
Type 302	7.9	0.29
Type 302B	8.0	0.29
Type 303	7.9	0.29
Type 304	7.9	0.29
Type 305	8.0	0.29
Type 308	8.0	0.29
Type 309	7.9	0.29
Type 310	7.9	0.29
Type 314	7.72	0.279
Type 316	8.0	0.29
Type 317	8.0	0.29
Type 321	7.9	0.29
Type 347	8.0	0.29
Type 403	7.7	0.28
Type 405	7.7	0.28
Type 410	7.7	0.28
Type 416	7.7	0.28
Type 420	7.7	0.28
Type 430	7.7	0.28
Type 430F	7.7	0.28
Type 431	7.7	0.28
Types 440A, 440B, 440C	7.7	0.28
Type 446	7.6	0.27
Type 501	7.7	0.28
Type 502	7.8	0.28
19-9DL	7.97	0.29
Precipitation-hardening stainless steels		
PH15-7 Mo	7.804	0.2819
17-4 PH	7.8	0.28
17-7 PH	7.81	0.282
Nickel-base alloys		
D-979	8.27	0.299
Nimonic 80A	8.25	0.298
Nimonic 90	8.27	0.299
M-252	8.27	0.298
Inconel	8.51	0.307
Inconel "X" 550	8.30	0.300
Inconel 700	8.17	0.295
Inconel "713C"	7.913	0.2859
Waspaloy	8.23	0.296
René 41	8.27	0.298
Hastelloy alloy B	9.24	0.334
Hastelloy alloy C	8.94	0.323
Hastelloy alloy X	8.23	0.297
Udimet 500	8.07	0.291
GMR-235	8.03	0.290
Cobalt-chromium-nickel-base alloys		
N-155 (HS-95)	8.23	0.296
S-590	8.36	0.301
Cobalt-base alloys		
S-816	8.68	0.314
V-36	8.60	0.311
HS-25	9.13	0.330
HS-36	9.04	0.327
HS-31	8.61	0.311
HS-21	8.30	0.300
Molybdenum-base alloy		
Mo-0.5Ti	10.2	0.368
Lead and lead alloys		
Chemical lead (99.90+% Pb)	11.34	0.4097
Corroding lead (99.73 +% Pb)	11.36	0.4104
Arsenical lead	11.34	0.4097
Calcium lead	11.34	0.4097
5-95 solder	11.0	0.397
20-80 solder	10.2	0.368
50-50 solder	8.89	0.321
Antimonial lead alloys		
1% antimonial lead	11.27	0.407
Hard lead (96Pb-4Sb)	11.04	0.399
Hard lead (94Pb-6Sb)	10.88	0.393
8% antimonial lead	10.74	0.388
9% antimonial lead	10.66	0.385
Lead-base Babbitt alloys		
Lead-base Babbitt		
SAE 13	10.24	0.370
SAE 14	9.73	0.352
Alloy 8	10.04	0.363
Arsenical lead		
Babbitt (SAE 15)	10.1	0.365
"G" Babbitt	10.1	0.365
Magnesium and magnesium alloys		
Magnesium (99.8%)	1.738	0.06279
Casting alloys		
AM100A	1.81	0.065
AZ63A	1.84	0.066
AZ81A	1.80	0.065
AZ91A, B, C	1.81	0.065
AZ92A	1.82	0.066
HK31A	1.79	0.065
HZ32A	1.83	0.066
ZH42, ZH62A	1.86	0.067
ZK51A	1.81	0.065
ZE41A	1.82	0.066
EZ33A	1.83	0.066
EK30A	1.79	0.065
EK41A	1.81	0.065
Wrought alloys		
M1A	1.76	0.064
A3A	1.77	0.064
AZ31B	1.77	0.064
PE	1.76	0.064
AZ61A	1.80	0.065
AZ80A	1.80	0.065
ZK60A, B	1.83	0.066
ZE10A	1.76	0.064
HM21A	1.78	0.064
HM31A	1.81	0.065
Nickel and nickel alloys		
Nickel (99.95% Ni + Co)	8.902	0.322
"A" Nickel	8.885	0.321
"D" Nickel	8.78	0.317
Duranickel	8.26	0.298
Cast nickel	8.34	0.301
Monel	8.84	0.319
"K" Monel	8.47	0.306
Monel (cast)	8.63	0.312
"H" Monel (cast)	8.5	0.31
"S" Monel (cast)	8.36	0.302
Inconel	8.51	0.307
Inconel (cast)	8.3	0.30
Ni-o-nel	7.86	0.294
Nickel-molybdenum-chromium-iron alloys		
Hastelloy B	9.24	0.334
Hastelloy C	8.94	0.323
Hastelloy D	7.8	0.282
Hastelloy F	8.17	0.295
Hastelloy N	8.79	0.317
Hastelloy W	9.03	0.326
Hastelloy X	8.23	0.297
Nickel-chromium-molybdenum-copper alloys		
Illium G	8.58	0.310
Illium R	8.58	0.310
Electrical resistance alloys		
80Ni-20Cr	8.4	0.30
60Ni-24Fe-16Cr	8.247	0.298
35Ni-45Fe-20Cr	7.95	0.287
Constantan	8.9	0.32
Tin and tin alloys		
Pure tin	7.3	0.264
Soft solder (30% Pb)	8.32	0.301
Soft solder (37% Pb)	8.42	0.304
Tin Babbitt		
Alloy 1	7.34	0.265
Alloy 2	7.39	0.267
Alloy 3	7.46	0.269
Alloy 4	7.53	0.272
Alloy 5	7.75	0.280
White metal	7.28	0.263
Pewter	7.28	0.263
Titanium and titanium alloys		
99.9% Ti	4.507	0.1628
99.2% Ti	4.507	0.1628
99.0% Ti	4.52	0.163
Ti-6A1-4V	4.43	0.160
Ti-5A1-2.5Sn	4.46	0.161
Ti-2Fe-2Cr-2Mo	4.65	0.168
Ti-8Mn	4.71	0.171
Ti-7Al-4Mo	4.48	0.162
Ti-4Al-4Mn	4.52	0.163
Ti-4Al-3Mo-1V	4.507	0.1628
Ti-2.5Al-16V	4.65	0.168
Zinc and zinc alloys		
Pure zinc	7.133	0.2577
AG40A alloy	6.6	0.24
AC41A alloy	6.7	0.24
Commercial rolled zinc		
0.08% Pb	7.14	0.258
0.06 Pb, 0.06 Cd	7.14	0.258
0.3 Pb, 0.3 Cd	7.14	0.258
Copper-hardened, rolled zinc (1% Cu)	7.18	0.259
Rolled zinc alloy (1 Cu, 0.010 Mg)	7.18	0.259
Zn-Cu-Ti alloy (0.8 Cu, 0.15 Ti)	7.18	0.259
Precious metals		
Silver	10.49	0.379
Gold	19.32	0.698
70Au-30Pt	19.92	...
Platinum	21.45	0.775
Pt-3.5Rh	20.9	...
Pt-5Rh	20.65	...
Pt-10Rh	19.97	...
Pt-20Rh	18.74	...
Pt-30Rh	17.62	...
Pt-40Rh	16.63	...
Pt-5Ir	21.49	...
Pt-10Ir	21.53	...
Pt-15Ir	21.57	...
Pt-20Ir	21.61	...
Pt-25Ir	21.66	...
Pt-30Ir	21.70	...

(continued)

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Table 1 (continued)

Metal or alloy	Density g/cm³	Density lb/in.³
Pt-35Ir	21.79	...
Pt-5Ru	20.67	...
Pt-10Ru	19.94	...
Palladium	12.02	0.4343
60Pd-40Cu	10.6	0.383
95.5Pd-4.5Ru	12.07(a)	...
95.5Pd-4.5Ru	11.62(b)	...
Permanent magnet materials		
Cunico	8.30	0.300
Cunife	8.61	0.311
Comol	8.16	0.295
Alnico I	6.89	0.249
Alnico II	7.09	0.256
Alnico III	6.89	0.249
Alnico IV	7.00	0.253
Alnico V	7.31	0.264
Alnico VI	7.42	0.268
Barium ferrite	4.7	0.17
Vectolite	3.13	0.113
Pure metals		
Antimony	6.62	0.239
Beryllium	1.848	0.067
Bismuth	9.80	0.354
Cadmium	8.65	0.313
Calcium	1.55	0.056
Cesium	1.903	0.069
Chromium	7.19	0.260
Cobalt	8.85	0.322
Gallium	5.907	0.213
Germanium	5.323	0.192
Hafnium	13.1	0.473
Indium	7.31	0.264
Iridium	22.5	0.813
Lithium	0.534	0.019
Manganese	7.43	0.270
Mercury	13.546	0.489
Molybdenum	10.22	0.369
Niobium	8.57	0.310
Osmium	22.583	0.816
Plutonium	19.84	0.717
Potassium	0.86	0.031
Rhenium	21.04	0.756
Rhodium	12.44	0.447
Ruthenium	12.2	0.441
Selenium	4.79	0.174
Silicon	2.33	0.084
Silver	10.49	0.379
Sodium	0.97	0.035
Tantalum	16.6	0.600
Thalium	11.85	0.428
Thorium	11.72	0.423
Tungsten	19.3	0.697
Uranium	19.07	0.689
Vanadium	6.1	0.22
Zirconium	6.5	0.23
Rare earth metals		
Cerium	8.23(c)	...
Cerium	6.66(d)	...
Cerium	6.77(e)	...
Dysprosium	8.55(f)	...
Erbium	9.15(f)	...
Europium	5.245(e)	...
Gadolinium	7.86(f)	...
Holmium	6.79(f)	...
Lanthanum	6.19(d)	...
Lanthanum	6.18(c)	...
Lanthanum	5.97(e)	...
Lutetium	9.85(f)	...
Neodymium	7.00(d)	...
Neodymium	6.80(e)	...
Praseodymium	6.77(d)	...
Praseodymium	6.64(e)	...
Samarium	7.49(g)	...
Scandium	2.99(f)	...
Terbium	8.25(f)	...
Thulium	9.31(f)	...
Ytterbium	6.96(c)	...
Yttrium	4.47(f)	...

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