KASPERCALC

HARDNESS CONVERSION CHART

Rockwell · superficial Rockwell · Vickers · Knoop · Brinell · Shore · approximate tensile strength

Read across a row to compare scales. Shaded column: the chart's key scale. – = not printed for that hardness ( ) = outside the recommended range of that test Conversions are approximate and only for the material named: test with the scale the drawing specifies.

Hardened Steel and Hard Alloys · TO 1-1A-9 Table 8-1

HRC Diamond (Brale), 150 kg	HRA Diamond (Brale), 60 kg	HRD Diamond (Brale), 100 kg	HR15N Diamond (N Brale), 15 kg	HR30N Diamond (N Brale), 30 kg	HR45N Diamond (N Brale), 45 kg	HV10 136° diamond pyramid, 10 kg	HB 10 mm ball, 3000 kg	HRG 1/16 in ball, 150 kg	HSc Diamond-tipped hammer, rebound
80	92.0	86.5	96.5	92.0	87.0	1865	–	–	–
79	91.5	85.5	–	91.5	86.5	1787	–	–	–
78	91.0	84.5	96.0	91.0	85.5	1710	–	–	–
77	90.5	84.0	–	90.5	84.5	1633	–	–	–
76	90.0	83.0	95.5	90.0	83.5	1556	–	–	–
75	89.5	82.5	–	89.0	82.5	1478	–	–	–
74	89.0	81.5	95.0	88.5	81.5	1400	–	–	–
73	88.5	81.0	–	88.0	80.5	1323	–	–	–
72	88.0	80.0	94.5	87.0	79.5	1245	–	–	–
71	87.0	79.5	–	86.5	78.5	1160	–	–	–
70	86.5	78.5	94.0	86.0	77.5	1076	–	–	–
69	86.0	78.0	93.5	85.0	76.5	1004	–	–	–
68	85.5	77.0	–	84.5	75.5	942	–	–	96.0
67	85.0	76.0	93.0	83.5	74.5	894	–	–	94.0
66	84.5	75.5	92.5	83.0	73.0	854	–	–	–
65	84.0	74.5	92.0	82.0	72.0	820	–	–	92.0
64	83.5	74.0	–	81.0	71.0	789	–	–	–
63	83.0	73.0	91.5	80.0	70.0	763	–	–	89.0
62	82.5	72.5	91.0	79.0	69.0	730	–	–	86.0
61	81.5	71.5	90.5	78.5	67.5	716	–	–	–
60	81.0	71.0	90.0	77.5	66.5	695	614	–	84.0
59	80.5	70.0	89.5	76.5	65.5	675	600	–	–
58	80.0	69.0	–	75.5	64.0	655	587	–	81.0
57	79.5	68.5	89.0	75.0	63.0	636	573	–	–
56	79.0	67.5	88.5	74.0	62.0	617	560	–	78.0
55	78.5	67.0	88.0	73.0	61.0	598	547	–	75.0
54	78.0	66.0	87.5	72.0	59.5	580	534	–	–
53	77.5	65.5	87.0	71.0	58.5	562	522	–	73.0
52	77.0	64.5	86.5	70.5	57.5	545	509	–	–
51	76.5	64.0	86.0	69.5	56.0	528	496	–	71.0
50	76.0	63.0	85.5	68.5	55.0	513	484	–	68.0
49	75.5	62.0	85.0	67.5	54.0	498	472	–	–
48	74.5	61.5	84.5	66.5	52.5	485	460	–	66.0
47	74.0	60.5	84.0	66.0	51.5	471	448	–	64.0
46	73.5	60.0	83.5	65.0	50.0	458	437	–	62.0
45	73.0	59.0	83.0	64.0	49.0	446	426	–	–
44	72.5	58.5	82.5	63.0	48.0	435	415	–	60.0
43	72.0	57.5	82.0	62.0	46.5	424	404	–	58.0
42	71.5	57.0	81.5	61.5	45.5	413	393	–	56.0
41	71.0	56.0	81.0	60.5	44.5	403	382	–	54.0
40	70.5	55.5	80.5	59.5	43.0	393	372	–	–
39	70.0	54.5	80.0	58.5	42.0	383	362	–	52.0
38	69.5	54.0	79.5	57.5	41.0	373	352	–	51.0
37	69.0	53.0	79.0	56.5	39.5	363	342	–	49.0
36	68.5	52.5	78.5	56.0	38.5	353	332	–	48.0
35	68.0	51.5	78.0	55.0	37.0	343	322	–	46.0
34	67.5	50.5	77.0	54.0	36.0	334	313	–	45.0
33	67.0	50.0	76.5	53.0	35.0	325	305	–	–
32	66.5	49.0	76.0	52.0	33.5	317	297	–	43.0
31	66.0	48.5	75.5	51.5	32.5	309	290	–	42.0
30	65.5	47.5	75.0	50.5	31.5	301	283	92.0	41.0
29	65.0	47.0	74.5	49.5	30.0	293	276	91.0	40.0
28	64.5	46.0	74.0	48.5	29.0	285	270	90.0	38.0
27	64.0	45.5	73.5	47.5	28.0	278	265	89.0	37.0
26	63.5	44.5	72.5	47.0	26.5	271	260	88.0	36.0
25	63.0	44.0	72.0	46.0	25.5	264	255	87.0	35.0
24	62.5	43.0	71.5	45.0	24.0	257	250	86.0	34.0
23	62.0	42.5	71.0	44.0	23.0	251	245	84.5	33.0
22	61.5	41.5	70.5	43.0	22.0	246	240	84.0	32.0
21	61.0	41.0	70.0	42.5	20.5	241	235	82.5	32.0
20	60.5	40.0	69.5	41.5	19.5	236	230	81.0	31.0

Vickers: 4-sided 136° diamond pyramid, 10 kg load, both diagonals measured by microscope. Brinell: 10 mm Hultgren ball, 3000 kg. The printed heading of the 30-N column reads "50-N"; its load is 30 kg.

Unhardened Steel, Soft-Temper Steel, Cast Iron and Most Non-Ferrous Metals · TO 1-1A-9 Tables 8-2 and 8-3

HRB 1/16 in ball, 100 kg	HRF 1/16 in ball, 60 kg	HRG 1/16 in ball, 150 kg	HR15T 1/16 in ball, 15 kg	HR30T 1/16 in ball, 30 kg	HR45T 1/16 in ball, 45 kg	HRE 1/8 in ball, 100 kg	HRH 1/8 in ball, 60 kg	HRK 1/8 in ball, 150 kg	HRA Diamond (Brale), 60 kg	HB 10 mm ball, 500 kg	HB 10 mm ball, 3000 kg	HSc Diamond-tipped hammer, rebound
100	–	82.5	93.0	82.0	72.0	–	–	–	61.5	201	240	33.0
99	–	81.0	92.5	81.5	71.0	–	–	–	61.0	195	234	32.0
98	–	79.0	–	81.0	70.0	–	–	–	60.0	189	228	32.0
97	–	77.5	92.0	80.5	69.0	–	–	–	59.5	184	222	31.0
96	–	76.0	–	80.0	68.0	–	–	–	59.0	179	216	30.0
95	–	74.0	91.5	79.0	67.0	–	–	–	58.0	175	210	30.0
94	–	72.5	–	78.5	66.0	–	–	–	57.5	171	205	29.0
93	–	71.0	91.0	78.0	65.5	–	–	–	57.0	167	200	28.0
92	–	69.0	90.5	77.5	64.5	–	–	100.0	56.5	163	195	28.0
91	–	67.5	–	77.0	63.5	–	–	99.5	56.0	160	190	27.0
90	–	66.0	90.0	76.0	62.5	–	–	98.5	55.5	157	185	27.0
89	–	64.0	89.5	75.5	61.5	–	–	98.0	55.0	154	180	25.0
88	–	62.5	–	75.0	60.5	–	–	97.0	54.0	151	176	25.0
87	–	61.0	89.0	74.5	59.5	–	–	96.5	53.5	148	172	24.0
86	–	59.0	88.5	74.0	58.5	–	–	95.5	53.0	145	169	24.0
85	–	57.5	–	73.5	58.0	–	–	94.5	52.5	142	165	23.0
84	–	56.0	88.0	73.0	57.0	–	–	94.0	52.0	140	162	23.0
83	–	54.0	87.5	72.0	56.0	–	–	93.0	51.0	137	159	23.0
82	–	52.5	–	71.5	55.0	–	–	92.0	50.5	135	156	23.0
81	–	51.0	87.0	71.0	54.0	–	–	91.0	50.0	133	153	22.0
80	–	49.0	86.5	70.0	53.0	–	–	90.5	49.5	130	150	22.0
79	–	47.5	–	69.5	52.0	–	–	89.5	49.0	128	147	21.0
78	–	46.0	86.0	69.0	51.0	–	–	88.5	48.5	126	144	21.0
77	–	44.0	85.5	68.0	50.0	–	–	88.0	48.0	124	141	20.0
76	–	42.5	–	67.5	49.0	–	–	87.0	47.0	122	139	–
75	99.5	41.0	85.0	67.0	48.5	–	–	86.0	46.5	120	137	–
74	99.0	39.0	–	66.0	47.5	–	–	85.0	46.0	118	135	–
73	98.5	37.5	84.5	65.5	46.5	–	–	84.5	45.5	116	132	–
72	98.0	36.0	84.0	65.0	45.5	–	–	83.5	45.0	114	130	–
71	97.5	34.5	–	64.0	44.5	100.0	–	82.5	44.5	112	127	–
70	97.0	32.5	83.5	63.5	43.5	99.5	–	81.5	44.0	110	125	–
69	96.0	31.0	83.0	62.5	42.5	99.0	–	81.0	43.5	109	123	–
68	95.5	29.5	–	62.0	41.5	98.0	–	80.0	43.0	107	121	–
67	95.0	28.0	82.5	61.5	40.5	97.5	–	79.0	42.5	106	119	–
66	94.5	26.5	82.0	60.5	39.5	97.0	–	78.0	42.0	104	117	–
65	94.0	25.0	–	60.0	38.5	96.0	–	77.5	–	102	116	–
64	93.5	23.5	81.5	59.5	37.5	95.5	–	76.5	41.5	101	114	–
63	93.0	22.0	81.0	58.5	36.5	95.0	–	75.5	41.0	99	112	–
62	92.0	20.5	–	58.0	35.5	94.5	–	74.5	40.5	98	110	–
61	91.5	19.0	80.5	57.0	34.5	93.5	–	74.0	40.0	96	108	–
60	91.0	17.5	–	56.5	33.5	93.0	–	73.0	39.5	95	107	–
59	90.5	16.0	80.0	56.0	32.0	92.5	–	72.0	39.0	94	106	–
58	90.0	14.5	79.5	55.0	31.0	92.0	–	71.0	38.5	92	104	–
57	89.5	13.0	–	54.5	30.0	91.0	–	70.5	38.0	91	103	–
56	89.0	11.5	79.0	54.0	29.0	90.5	–	69.5	–	90	101	–
55	88.0	10.0	78.5	53.0	28.0	90.0	–	68.5	37.5	89	100	–
54	87.5	8.5	–	52.5	27.0	89.5	–	68.0	37.0	87	–	–
53	87.0	7.0	78.0	51.5	26.0	89.0	–	67.0	36.5	86	–	–
52	86.5	5.5	77.5	51.0	25.0	88.0	–	66.0	36.0	85	–	–
51	86.0	4.0	–	50.5	24.0	87.5	–	65.0	35.5	84	–	–
50	85.5	–	77.0	49.5	23.0	87.0	–	64.5	35.0	83	–	–
49	85.0	–	76.5	49.0	22.0	86.5	–	63.5	–	82	–	–
48	84.5	–	–	48.5	20.5	85.5	–	62.5	34.5	81	–	–
47	84.0	–	76.0	47.5	19.5	85.0	–	61.5	34.0	80	–	–
46	83.0	–	75.5	47.0	18.5	84.5	–	61.0	33.5	–	–	–
45	82.5	–	–	46.0	17.5	84.0	–	60.0	33.0	79	–	–
44	82.0	–	75.0	45.5	16.5	83.5	–	59.0	32.5	78	–	–
43	81.5	–	74.5	45.0	15.5	82.5	–	58.0	32.0	77	–	–
42	81.0	–	–	44.0	14.5	82.0	–	57.5	31.5	76	–	–
41	80.5	–	74.0	43.5	13.5	81.5	–	56.5	31.0	75	–	–
40	79.5	–	73.5	43.0	12.5	81.0	–	55.5	–	–	–	–
39	79.0	–	–	42.0	11.0	80.0	–	54.5	30.5	74	–	–
38	78.5	–	73.0	41.5	10.0	79.5	–	54.0	30.0	73	–	–
37	78.0	–	72.5	40.5	9.0	79.0	–	53.0	29.5	72	–	–
36	77.5	–	–	40.0	8.0	78.5	100.0	52.0	29.0	–	–	–
35	77.0	–	72.0	39.5	7.0	78.0	99.5	51.5	28.5	71	–	–
34	76.5	–	71.5	38.5	6.0	77.0	99.0	50.5	28.0	70	–	–
33	75.5	–	–	38.0	5.0	76.5	–	49.5	–	69	–	–
32	75.0	–	71.0	37.5	4.0	76.0	98.5	48.5	27.5	–	–	–
31	74.5	–	–	36.5	3.0	75.5	98.0	48.0	27.0	68	–	–
30	74.0	–	70.5	36.0	2.0	75.0	–	47.0	26.5	67	–	–
29	73.5	–	70.0	35.5	1.0	74.0	97.5	46.0	26.0	–	–	–
28	73.0	–	–	34.5	–	73.5	97.0	45.0	25.5	66	–	–
27	72.5	–	69.5	34.0	–	73.0	96.5	44.5	25.0	–	–	–
26	72.0	–	69.0	33.0	–	72.5	–	43.5	24.5	65	–	–
25	71.0	–	–	32.5	–	72.0	96.0	42.5	–	64	–	–
24	70.5	–	68.5	32.0	–	71.0	95.5	41.5	24.0	–	–	–
23	70.0	–	68.0	31.0	–	70.5	–	41.0	23.5	63	–	–
22	69.5	–	–	30.5	–	70.0	95.0	40.0	23.0	–	–	–
21	69.0	–	67.5	29.5	–	69.5	94.5	39.0	22.5	62	–	–
20	68.5	–	–	29.0	–	68.5	–	38.0	22.0	–	–	–
19	68.0	–	67.0	28.5	–	68.0	94.0	37.5	21.5	61	–	–
18	67.0	–	66.5	27.5	–	67.5	93.5	36.5	–	–	–	–
17	66.5	–	–	27.0	–	67.0	93.0	35.5	21.0	60	–	–
16	66.0	–	66.0	26.0	–	66.5	–	35.0	20.5	–	–	–
15	65.5	–	65.5	25.5	–	65.5	92.5	34.0	20.0	59	–	–
14	65.0	–	–	25.0	–	65.0	92.0	33.0	–	–	–	–
13	64.5	–	65.0	24.0	–	64.5	–	32.0	–	58	–	–
12	64.0	–	64.5	23.5	–	64.0	91.5	31.5	–	–	–	–
11	63.5	–	–	23.0	–	63.5	91.0	30.5	–	–	–	–
10	63.0	–	64.0	22.0	–	62.5	90.5	29.5	–	57	–	–
9	62.0	–	–	21.5	–	62.0	–	29.0	–	–	–	–
8	61.5	–	63.5	20.5	–	61.5	90.0	28.0	–	–	–	–
7	61.0	–	63.0	20.0	–	61.0	89.5	27.0	–	56	–	–
6	60.5	–	–	19.5	–	60.5	–	26.0	–	–	–	–
5	60.0	–	62.5	18.5	–	60.0	89.0	25.5	–	55	–	–
4	59.5	–	62.0	18.0	–	59.0	88.5	24.5	–	–	–	–
3	59.0	–	–	17.0	–	58.5	88.0	23.5	–	–	–	–
2	58.0	–	61.5	16.5	–	58.0	–	23.0	–	54	–	–
1	57.5	–	61.0	16.0	–	57.5	87.5	22.0	–	–	–	–
0	57.0	–	–	15.0	–	57.0	87.0	21.0	–	53	–	–

Brinell: standard 10 mm ball at 500 kg and 3000 kg. Rockwell B numbers above 100 are above the practical range of the B scale (see the table below the chart).

Approximate Tensile Strength of Carbon and Low Alloy Steels · TO 1-1A-9 Table 8-5

HRC Diamond (Brale), 150 kg	HRB 1/16 in ball, 100 kg	HV50 136° diamond pyramid, 50 kg	HBW 10 mm tungsten carbide ball, printed as 300 kg	HBS 10 mm steel ball, printed as 300 kg	Tensile ksi (1000 psi)
67	–	918	820	717	–
66	–	884	796	701	–
65	–	852	774	686	–
64	–	822	753	671	–
63	–	793	732	656	–
62	–	765	711	642	–
61	–	740	693	628	–
60	–	717	675	613	–
59	–	694	657	600	–
58	–	672	639	584	–
57	–	650	621	574	–
56	121.3	630	604	561	–
55	120.8	611	588	548	–
54	120.2	592	571	536	–
53	119.6	573	554	524	283
52	119.1	556	538	512	273
51	118.5	539	523	500	264
50	117.9	523	508	488	256
49	117.4	508	494	476	246
48	116.8	493	479	464	237
47	116.2	479	465	453	231
46	115.6	465	452	442	221
45	115	452	440	430	215
44	114.4	440	427	419	208
43	113.8	428	415	408	201
42	113.3	417	405	398	194
41	112.7	406	394	387	188
40	112.1	396	385	377	181
39	111.5	386	375	367	176
38	110.9	376	365	357	170
37	110.4	367	356	347	165
36	109.7	357	346	337	160
35	109.1	348	337	327	155
34	108.5	339	329	318	150
33	107.8	330	319	309	147
32	107.1	321	310	301	142
31	106.4	312	302	294	139
30	105.7	304	293	286	136
29	105	296	286	279	132
28	104.3	288	278	272	129
27	130.7*	281	271	265	126
26	102.9	274	264	259	123
25	102.2	267	258	253	120
24	101.5	261	252	247	118
23	100.8	255	246	241	115
22	100.2	250	241	235	112
21	99.5	245	236	230	110
20	98.9	240	231	225	107
19	98.1	235	226	220	104
18	97.5	231	222	215	103
17	96.9	227	218	210	102
16	96.2	223	214	206	100
15	95.5	219	210	201	99
14	94.9	215	206	197	97
13	94.1	211	202	193	95
12	93.4	207	199	190	93
11	92.6	203	195	186	91
10	91.8	199	191	183	90
9	91.2	196	187	180	89
8	90.3	192	184	177	88
7	89.7	189	180	174	87
6	89	186	177	171	85
5	88.3	183	174	168	84
4	87.5	179	171	165	83
3	87	177	169	162	82
2	86	173	165	160	81
1	85.5	171	163	158	80
0	84.5	167	159	154	78
–	83.2	162	153	150	76
–	82	157	148	145	74
–	80.5	153	144	140	72
–	79	149	140	136	70
–	77.5	143	134	131	68
–	76	139	130	127	66
–	74	135	126	122	64
–	72	129	120	117	62
–	70	125	116	113	60
–	68	120	111	108	58
–	66	116	107	104	56
–	64	112	104	100	54
–	61	108	100	96	52
–	58	104	95	92	50
–	55	99	91	87	48
–	51	95	86	83	46
–	47	91	83	79	44
–	44	88	80	76	42
–	39	84	76	72	40
–	35	80	72	68	38
–	30	76	67	64	36
–	24	72	64	60	34
–	20	69	61	57	32
–	11	65	57	53	30
–	0	62	54	50	28

For plain carbon and low alloy steels only. The Brinell heading is printed "300 Kilogram Load - 10 Millimeter Ball" with a footnote mark (3) that has no footnote text in the TO. * Printed as shown in TO 1-1A-9; evidently a misprint.