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**Hardness Conversion Charts & Calculator \***

**Comparison of Hardness Scales approx.\*\* and Tensile Stress Equivalents approx. (maximum value) in imperial and metric units.**

Rockwell 'C' Scale (HRC)	Vickers Diamond Penetrator Scale HV10 HV30	Brinell			Tensile Stress Equivalents				Shore Scleroscope Hardness Number	Rockwell		Vickers Diamond Penetrator Scale HV10 HV30
		Dia. Imp. for 10mm Ball	Carbide Ball	Standard Ball	Tons/in <sup>2</sup>	1000lb/in <sup>2</sup>	kg/mm <sup>2</sup>	MPa {N/mm <sup>2</sup> }		A Scale, 60-kgf (HRA)	'C' Scale (HRC)	
67.7	900								96	85.6	67.7	900
67.0	880								95	85.0	67.0	880
66.3	860								93	84.7	66.3	860
65.5	840								92	84.2	65.5	840
64.8	820								90	83.8	64.8	820
64.0	800								88	83.4	64.0	800
63.3	780								87	83.0	63.3	780
62.5	760								86	82.6	62.5	760
61.7	740								84	82.2	61.7	740
61.0	725	2.44	630	-	-	-	-	-	82	81.8	61.0	725
60.5	710	2.45	627	-	-	-	-	-	-	81.5	60.5	710
60.0	698	2.50	601	-	132	295	208	2039	81	81.2	60.0	698
58.9	670	2.55	578	-	127	284	200	1961	78	80.6	58.9	670
57.1	630	2.60	555	-	122	273	192	1884	75	79.6	57.1	630
56.1	609	2.65	534	-	117	262	184	1807	73	79.0	56.1	609
54.4	572	2.70	514	-	112	250	176	1729	71	78.2	54.4	572
51.9	532	2.75	495	495	108	241	170	1668	68	76.9	51.9	532
50.7	517	2.80	477	477	105	235	165	1621	66	76.3	50.7	517
49.5	497	2.85	461	461	101	226	160	1559	64	75.5	49.5	497
47.5	470	2.90	444	444	98	219	155	1513	62	74.2	47.5	470
46.0	452	2.95	429	429	95	212	150	1467	60	73.5	46.0	452
44.8	437	3.00	415	415	92	206	145	1420	58	73.0	44.8	437
43.7	422	3.05	401	401	88	197	139	1359	56	72.5	43.7	422
42.4	408	3.10	388	388	85	190	134	1312	54	71.5	42.4	408
41.3	395	3.15	375	375	82	183	129	1266	52	71.0	41.3	395
39.9	381	3.20	363	363	80	179	126	1235	51	70.3	39.9	381
38.8	370	3.25	352	352	77	172	121	1189	49	69.8	38.8	370
37.7	359	3.30	341	341	75	168	118	1158	48	69.2	37.7	359

36.7	349	3.35	331	331	73	163	114	1127	46	68.8	36.7	349
35.0	337	3.40	321	321	71	159	111	1096	45	68.0	35.0	337
34.0	327	3.45	311	311	68	152	107	1050	43	67.5	34.0	327
33.0	318	3.50	302	302	66	147	104	1019	42	66.8	33.0	318
32.0	308	3.55	293	293	64	143	101	988	41	66.2	32.0	308
30.9	300	3.60	285	285	63	141	99	973	40	65.7	30.9	300
29.8	292	3.65	277	277	61	136	96	942	38	65.2	29.8	292
29.0	284	3.70	269	269	59	132	93	911	37	64.6	29.0	284
27.5	275	3.75	262	262	58	130	91	895	36	64.0	27.5	275
26.6	269	3.80	255	255	56	125	89	865	35	63.6	26.6	269
25.2	261	3.85	248	248	55	123	87	849	34	62.9	25.2	261
24.3	255	3.90	241	241	53	118	84	818	33	62.6	24.3	255
23.0	247	3.95	235	235	51	114	81	787	32	62.0	23.0	247
22.0	241	4.00	229	229	50	112	79	772	31	61.6	22.0	241
20.8	234	4.05	223	223	49	110	77	756	30	60.7	20.8	234
	228	4.10	217	217	48	107	76	741	-	-	-	228
Hardness 'B' Scale HRB											Hardness 'B' Scale HRB	
98	222	4.15	212	212	46	103	73	710	29	-	98	222
97	218	4.20	207	207	45	101	71	695	28	-	97	218
96	212	4.30	197	197	43	97	68	664	27	-	96	212
93	196	4.40	187	187	41	92	65	632	25	-	93	196
91	188	4.50	179	179	39	88	62	602	-	-	91	188
88.5	178	4.60	170	170	36	81	57	556	24	-	88.5	178
86	171	4.70	163	163	35	78	55	540	-	-	86	171
84.2	163	4.80	156	156	34	76	54	525	23	-	84.2	163
82	156	4.90	149	149	32	72	51	494	-	-	82	156
80	150	5.00	143	143	31	69	49	479	22	-	80	150
77	143	5.10	137	137	30	67	48	463	21	-	77	143
75	137	5.20	131	131	29.5	66	47	455	20.5	-	75	137
72.5	132	5.30	126	126	29	65	46	448	20	-	72.5	132
70	127	5.40	121	121	28	63	44	432	-	-	70	127
67	122	5.50	116	116	26	58	42	401	15	-	67	122

\*These charts were prepared using information contained in B.S.860/1967. This standard differs significantly from the superseded standard B.S. 860/1939, and differs slightly from the conversion scales adopted by SAE and ASTM sources.

\*\* Where hardness acceptance values are specified and a conversion from one scale to another is necessary the source of the conversion data should be stated and understood by the parties involved.

**Hardness Conversion Chart**

Rockwell						Rockwell Superficial				Brinell		Vickers	Shore	
A	B	C	D	E	F	15-N	30-N	45-N	30-T	500 kg	3000 kg	136		Approx.
60kg Brale	100kg 1/16" Ball	150kg Brale	100kg Brale	100kg 1/8" Ball	60kg 1/16" Ball	15kg Brale	30kg Brale	45kg Brale	30 kg 1/16" Ball	10mm Ball Steel	10mm Ball Steel	Diamond Pyramid	Sclero-scope	Tensile Strength (psi)
86.5	-	70	78.5	-	-	94	86	77.6	-	-	-	1076	101	-
86	-	69	77.7	-	-	93.5	85	76.5	-	-	-	1044	99	-

85.6	-	68	76.9	-	-	93.2	84.4	75.4	-	-	-	940	97	-
85	-	67	76.1	-	-	92.9	83.6	74.2	-	-	-	900	95	-
84.5	-	66	75.4	-	-	92.5	82.8	73.2	-	-	-	865	92	-
83.9	-	65	74.5	-	-	92.2	81.9	72	-	-	739	832	91	-
83.4	-	64	73.8	-	-	91.8	81.1	71	-	-	722	800	88	-
82.8	-	63	73	-	-	91.4	80.1	69.9	-	-	705	772	87	-
82.3	-	62	72.2	-	-	91.1	79.3	68.8	-	-	688	746	85	-
81.8	-	61	71.5	-	-	90.7	78.4	67.7	-	-	670	720	83	-
81.2	-	60	70.7	-	-	90.2	77.5	66.6	-	-	654	697	81	320,000
80.7	-	59	69.9	-	-	89.8	76.6	65.5	-	-	634	674	80	310,000
80.1	-	58	69.2	-	-	89.3	75.7	64.3	-	-	615	653	78	300,000
79.6	-	57	68.5	-	-	88.9	74.8	63.2	-	-	595	633	76	290,000
79	-	56	67.7	-	-	88.3	73.9	62	-	-	577	613	75	282,000
78.5	120	55	66.9	-	-	87.9	73	60.9	-	-	560	595	74	274,000
78	120	54	66.1	-	-	87.4	72	59.8	-	-	543	577	72	266,000
77.4	119	53	65.4	-	-	86.9	71.2	58.6	-	-	525	560	71	257,000
76.8	119	52	64.6	-	-	86.4	70.2	57.4	-	-	500	544	69	245,000
76.3	118	51	63.8	-	-	85.9	69.4	56.1	-	-	487	528	68	239,000
75.9	117	50	63.1	-	-	85.5	68.5	55	-	-	475	513	67	233,000
75.2	117	49	62.1	-	-	85	67.6	53.8	-	-	464	498	66	227,000
74.7	116	48	61.4	-	-	84.5	66.7	52.5	-	-	451	484	64	221,000
74.1	116	47	60.8	-	-	83.9	65.8	51.4	-	-	442	471	63	217,000
73.6	115	46	60	-	-	83.5	64.8	50.3	-	-	432	458	62	212,000
73.1	115	45	59.2	-	-	83	64	49	-	-	421	446	60	206,000
72.5	114	44	58.5	-	-	82.5	63.1	47.8	-	-	409	434	58	200,000
72	113	43	57.7	-	-	82	62.2	46.7	-	-	400	423	57	196,000
71.5	113	42	56.9	-	-	81.5	61.3	45.5	-	-	390	412	56	191,000
70.9	112	41	56.2	-	-	80.9	60.4	44.3	-	-	381	402	55	187,000
70.4	112	40	55.4	-	-	80.4	59.5	43.1	-	-	371	392	54	182,000
69.9	111	39	54.6	-	-	79.9	58.6	41.9	-	-	362	382	52	177,000
69.4	110	38	53.8	-	-	79.4	57.7	40.8	-	-	353	372	51	173,000
68.9	110	37	53.1	-	-	78.8	56.8	39.6	-	-	344	363	50	169,000
68.4	109	36	52.3	-	-	78.3	55.9	38.4	-	-	336	354	49	165,000
67.9	109	35	51.5	-	-	77.7	55	37.2	-	-	327	345	48	160,000
67.4	108	34	50.8	-	-	77.2	54.2	36.1	-	-	319	336	47	156,000
66.8	108	33	50	-	-	76.6	53.3	34.9	-	-	311	327	46	152,000
66.3	107	32	49.2	-	-	76.1	52.1	33.7	-	-	301	318	44	147,000
65.8	106	31	48.4	-	-	75.6	51.3	32.5	-	-	294	310	43	144,000
65.3	105	30	47.7	-	-	75	50.4	31.3	-	-	286	302	42	140,000
64.7	104	29	47	-	-	74.5	49.5	30.1	-	-	279	294	41	137,000
64.3	104	28	46.1	-	-	73.9	48.6	28.9	-	-	271	286	41	133,000
63.8	103	27	45.2	-	-	73.3	47.7	27.8	-	-	264	279	40	129,000
63.3	103	26	44.6	-	-	72.8	46.8	26.7	-	-	258	272	39	126,000
62.8	102	25	43.8	-	-	72.2	45.9	25.5	-	-	253	266	38	124,000

62.4	101	24	43.1	-	-	71.6	45	24.3	-	-	247	260	37	121,000
62	100	23	42.1	-	-	71	44	23.1	82	201	240	254	36	118,000
61.5	99	22	41.6	-	-	70.5	43.2	22	81.5	195	234	248	35	115,000
61	98	21	40.9	-	-	69.9	42.3	20.7	81	189	228	243	35	112,000
60.5	97	20	40.1	-	-	69.4	41.5	19.6	80.5	184	222	238	34	109,000
59	96	18	-	-	-	-	-	-	80	179	216	230	33	106,000
58	95	16	-	-	-	-	-	-	79	175	210	222	32	103,000
57.5	94	15	-	-	-	-	-	-	78.5	171	205	213	31	100,000
57	93	13	-	-	-	-	-	-	78	167	200	208	30	98,000
56.5	92	12	-	-	-	-	-	-	77.5	163	195	204	29	96,000
56	91	10	-	-	-	-	-	-	77	160	190	196	28	93,000
55.5	90	9	-	-	-	-	-	-	76	157	185	192	27	91,000
55	89	8	-	-	-	-	-	-	75.5	154	180	188	26	88,000
54	88	7	-	-	-	-	-	-	75	151	176	184	26	86,000
53.5	87	6	-	-	-	-	-	-	74.5	148	172	180	26	84,000
53	86	5	-	-	-	-	-	-	74	145	169	176	25	83,000
52.5	85	4	-	-	-	-	-	-	73.5	142	165	173	25	81,000
52	84	3	-	-	-	-	-	-	73	140	162	170	25	79,000
51	83	2	-	-	-	-	-	-	72	137	159	166	24	78,000
50.5	82	1	-	-	-	-	-	-	71.5	135	156	163	24	76,000
50	81	0	-	-	-	-	-	-	71	133	153	160	24	75,000
49.5	80	-	-	-	-	-	-	-	70	130	150	-	-	73,000
49	79	-	-	-	-	-	-	-	69.5	128	147	-	-	-
48.5	78	-	-	-	-	-	-	-	69	126	144	-	-	-
48	77	-	-	-	-	-	-	-	68	124	141	-	-	-
47	76	-	-	-	-	-	-	-	67.5	122	139	-	-	-
46.5	75	-	-	-	99.5	-	-	-	67	120	137	-	-	-
46	74	-	-	-	99	-	-	-	66	118	135	-	-	-
45.5	73	-	-	-	98.5	-	-	-	65.5	116	132	-	-	-
45	72	-	-	-	98	-	-	-	65	114	130	-	-	-
44.5	71	-	-	100	97.5	-	-	-	64.2	112	127	-	-	-
44	70	-	-	99.5	97	-	-	-	63.5	110	125	-	-	-
43.5	69	-	-	99	96	-	-	-	62.8	109	123	-	-	-
43	68	-	-	98	95.5	-	-	-	62	107	121	-	-	-
42.5	67	-	-	97.5	95	-	-	-	61.4	106	119	-	-	-
42	66	-	-	97	94.5	-	-	-	60.5	104	117	-	-	-
41.8	65	-	-	96	94	-	-	-	60.1	102	116	-	-	-
41.5	64	-	-	95.5	93.5	-	-	-	59.5	101	114	-	-	-
41	63	-	-	95	93	-	-	-	58.7	99	112	-	-	-
40.5	62	-	-	94.5	92	-	-	-	58	98	110	-	-	-
40	61	-	-	93.5	91.5	-	-	-	57.3	96	108	-	-	-
39.5	60	-	-	93	91	-	-	-	56.5	95	107	-	-	-
39	59	-	-	92.5	90.5	-	-	-	55.9	94	106	-	-	-
38.5	58	-	-	92	90	-	-	-	55	92	104	-	-	-
38	57	-	-	91	89.5	-	-	-	54.6	91	102	-	-	-

37.8	56	-	-	90.5	89	-	-	-	54	90	101	-	-	-
37.5	55	-	-	90	88	-	-	-	53.2	89	99	-	-	-
37	54	-	-	89.5	87.5	-	-	-	52.5	87	-	-	-	-
36.5	53	-	-	89	87	-	-	-	51.8	86	-	-	-	-
36	52	-	-	88	86.5	-	-	-	51	85	-	-	-	-
35.5	51	-	-	87.5	86	-	-	-	50.4	84	-	-	-	-
35	50	-	-	87	85.5	-	-	-	49.5	83	-	-	-	-
34.8	49	-	-	86.5	85	-	-	-	49.1	82	-	-	-	-
34.5	48	-	-	85.5	84.5	-	-	-	48.5	81	-	-	-	-
34	47	-	-	85	84	-	-	-	47.7	80	-	-	-	-
33.5	46	-	-	84.5	83	-	-	-	47	79	-	-	-	-
33	45	-	-	84	82.5	-	-	-	46.2	79	-	-	-	-
32.5	44	-	-	83.5	82	-	-	-	45.5	78	-	-	-	-
32	43	-	-	82.5	81.5	-	-	-	44.8	77	-	-	-	-
31.5	42	-	-	82	81	-	-	-	44	76	-	-	-	-
31	41	-	-	81.5	80.5	-	-	-	43.4	75	-	-	-	-
30.8	40	-	-	81	79.5	-	-	-	43	74	-	-	-	-
30.5	39	-	-	80	79	-	-	-	42.1	74	-	-	-	-
30	38	-	-	79.5	78.5	-	-	-	41.5	73	-	-	-	-
29.5	37	-	-	79	78	-	-	-	40.7	72	-	-	-	-
29	36	-	-	78.5	77.5	-	-	-	40	71	-	-	-	-
28.5	35	-	-	78	77	-	-	-	39.3	71	-	-	-	-
28	34	-	-	77	76.5	-	-	-	38.5	70	-	-	-	-
27.8	33	-	-	76.5	75.5	-	-	-	37.9	69	-	-	-	-
27.5	32	-	-	76	75	-	-	-	37.5	68	-	-	-	-
27	31	-	-	75.5	74.5	-	-	-	36.6	68	-	-	-	-
26.5	30	-	-	75	74	-	-	-	36	67	-	-	-	-
26	29	-	-	74	73.5	-	-	-	35.2	66	-	-	-	-
25.5	28	-	-	73.5	73	-	-	-	34.5	66	-	-	-	-
25	27	-	-	73	72.5	-	-	-	33.8	65	-	-	-	-
24.5	26	-	-	72.5	72	-	-	-	33.1	65	-	-	-	-
24.2	25	-	-	72	71	-	-	-	32.4	64	-	-	-	-
24	24	-	-	71	70.5	-	-	-	32	64	-	-	-	-
23.5	23	-	-	70.5	70	-	-	-	31.1	63	-	-	-	-
23	22	-	-	70	69.5	-	-	-	30.4	63	-	-	-	-
22.5	21	-	-	69.5	69	-	-	-	29.7	62	-	-	-	-
22	20	-	-	68.5	68.5	-	-	-	29	62	-	-	-	-
21.5	19	-	-	68	68	-	-	-	28.1	61	-	-	-	-
21.2	18	-	-	67.5	67	-	-	-	27.4	61	-	-	-	-
21	17	-	-	67	66.5	-	-	-	26.7	60	-	-	-	-
20.5	16	-	-	66.5	66	-	-	-	26	60	-	-	-	-
20	15	-	-	65.5	65.5	-	-	-	25.3	59	-	-	-	-
-	14	-	-	65	65	-	-	-	24.6	59	-	-	-	-
-	13	-	-	64.5	64.5	-	-	-	23.9	58	-	-	-	-

-	12	-	-	64	64	-	-	-	23.5	58	-	-	-	-
-	11	-	-	63.5	63.5	-	-	-	22.6	57	-	-	-	-
-	10	-	-	62.5	63	-	-	-	21.9	57	-	-	-	-
-	9	-	-	62	62	-	-	-	21.2	56	-	-	-	-
-	8	-	-	61.5	61.5	-	-	-	20.5	56	-	-	-	-
-	7	-	-	61	61	-	-	-	19.8	56	-	-	-	-
-	6	-	-	60.5	60.5	-	-	-	19.1	55	-	-	-	-
-	5	-	-	60	60	-	-	-	18.4	55	-	-	-	-
-	4	-	-	59	59.5	-	-	-	18	55	-	-	-	-
-	3	-	-	58.5	59	-	-	-	17.1	54	-	-	-	-
-	2	-	-	58	58	-	-	-	16.4	54	-	-	-	-
-	1	-	-	57.5	57.5	-	-	-	15.7	53	-	-	-	-
-	0	-	-	57	57	-	-	-	15	53	-	-	-	-

[Click for the ASTM E140 - 07 document: Standard Hardness Conversion Tables for Metals Relationship Among Brinell Hardness, Vickers Hardness, Rockwell Hardness, Superficial Hardness, Knoop Hardness, and Scleroscope Hardness](#)

Hardness

Hardness is the property of a material that enables it to resist plastic deformation, penetration, indentation, and scratching. Therefore, hardness is important from an engineering standpoint because resistance to wear by either friction or erosion by steam, oil, and water generally increases with hardness.

Hardness tests serve an important need in industry even though they do not measure a unique quality that can be termed hardness. The tests are empirical, based on experiments and observation, rather than fundamental theory. Its chief value is as an inspection device, able to detect certain differences in material when they arise even though these differences may be undefinable. For example, two lots of material that have the same hardness may or may not be alike, but if their hardness is different, the materials certainly are not alike.

Several methods have been developed for hardness testing. Those most often used are Brinell, Rockwell, Vickers, Tukon, Sclerscope, and the files test. The first four are based on indentation tests and the fifth on the rebound height of a diamond-tipped metallic hammer. The file test establishes the characteristics of how well a file takes a bite on the material.

As a result of many tests, comparisons have been prepared using formulas, tables, and graphs that show the relationships between the results of various hardness tests of specific alloys. There is, however, no exact mathematical relation between any two of the methods. For this reason, the result of one type of hardness test converted to readings of another type should carry the notation "\_\_\_\_ converted from \_\_\_\_" (for example "352 Brinell converted from Rockwell C-38").

Another convenient conversion is that of Brinell hardness to ultimate tensile strength. For quenched and tempered steel, the tensile strength (psi) is about 500 times the Brinell hardness number (provided the strength is not over 200,000 psi).

*Hardness conversion calculator: astm E 140 - 97*

from

to

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1) Standard Hardness Conversion for metals acc. ASTM E 140 - 97, September 1999, Conversion for Non-Austenitic Steels, Table 1. The accuracy of the conversion depends

on the accuracy of the provided data and the resulting curve-fits.

2) Indentation hardness is not a single fundamental property but a combination of properties, and varies with the type of test. The modulus of elasticity and the depth of indentation influence conversions. Therefore separate conversion tables are necessary for different materials.

3) Brinell Hardness numbers in parentheses are outside the range (HB>630) This limit is set to avoid errors introduced by the deformation of the ball indenter itself.

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