Wilson® | Hardness Conversion Chart

Hardened Steel and Hardened Alloys

Rockwell C	Rockwell A	Rockwell D	Rockwell G	Superficial 15-N	Superficial 30-N	Superficial 45-N	Vickers HV	Knoop HK	Brinell HB	Tensile Strength KSI	Micro-ficial WMN
150 kg Brale	60 kg Brale	100 kg Brale	150 kg 1/16" ball	15 kg N Brale	30 kg N Brale	45 kg N Brale	10 kg	500 gm and over	3000 kg 10 mm ball	1000 lbs/ sq in	1000 gm
80	92.0	86.5		96.5	92.0	87.0	1865	-			-
79	91.5	85.5		96.3	91.5	86.5	1787	-			-
78	91.0	84.5		96.0	91.0	85.5	1710	-			-
77	90.5	84.0		95.8	90.5	84.5	1633	-			-
76	90.0	83.0		95.5	90.0	83.5	1556	-			-
75	89.5	82.5		95.3	89.0	82.5	1478	-			-
74	89.0	81.5		95.0	88.5	81.5	1400	-			-
73	88.5	81.0		94.8	88.0	80.5	1323	-			-
72	88.0	80.0		94.5	87.0	79.5	1245	-			-
71	87.0	79.5		94.3	86.5	78.5	1160	-	NOTE 1	NOTE 2	-
70	86.5	78.5		94.0	86.0	77.5	1076	972			953
69	86.0	78.0		93.5	85.0	76.5	1004	946			949
68	85.6	76.9		93.2	84.4	75.4	940	920			945
67	85.0	76.1		92.9	83.6	74.2	900	895			942
66	84.5	75.4		92.5	82.8	73.3	865	870	NA		938
65	83.9	74.5		92.2	81.9	72.0	832	846	739		934
64	83.4	73.8		91.8	81.1	71.0	800	822	722		930
63	82.8	73.0		91.4	80.1	69.9	772	799	706		926
62	82.3	72.2		91.1	79.3	68.8	746	776	688		922
61	81.8	71.5		90.7	78.4	67.7	720	754	670		917
60	81.2	70.7		90.2	77.5	66.6	697	732	654	NA	913
59	80.7	69.9		89.8	76.6	65.5	674	710	634	351	909
58	80.1	69.2		89.3	75.7	64.3	653	690	615	338	904
57	79.6	68.5		88.9	74.8	63.2	633	670	595	325	900
56	79.0	67.7		88.3	73.9	62.0	613	650	577	313	896
55	78.5	66.9		87.9	73.0	60.9	595	630	560	301	891
54	78.0	66.1		87.4	72.0	59.8	577	612	543	292	887
53	77.4	65.4		86.9	71.2	58.6	560	594	525	283	883
52	76.8	64.6		86.4	70.2	57.4	544	576	512	273	879
51	76.3	63.8		85.9	69.4	56.1	528	558	496	264	874
50	75.9	63.1		85.5	68.5	55.0	513	542	481	255	870
49	75.2	62.1		85.0	67.6	53.8	498	526	469	246	865
48	74.7	61.4		84.5	66.7	52.5	484	510	455	238	861
47	74.1	60.8		83.9	65.8	51.4	471	495	443	229	856
46	73.6	60.0		83.5	64.8	50.3	458	480	432	221	851
45	73.1	59.2		83.0	64.0	49.0	446	466	421	215	847
44	72.5	58.5		82.5	63.1	47.8	434	452	409	208	842
43	72.0	57.7		82.0	62.2	46.7	423	438	400	201	837
42	71.5	56.9		81.5	61.3	45.5	412	426	390	194	832
41	70.9	56.2		80.9	60.4	44.3	402	414	381	188	827
40	70.4	55.4		80.4	59.5	43.1	392	402	371	182	822
39	69.9	54.6		79.9	58.6	41.9	382	391	362	177	817
38	69.4	53.8		79.4	57.7	40.8	372	380	353	171	812
37	68.9	53.1		78.8	56.8	39.6	363	370	344	166	807
36	68.4	52.3		78.3	55.9	38.4	354	360	336	161	802
35	67.9	51.5		77.7	55.0	37.2	345	351	327	156	798
34	67.4	50.8		77.2	54.2	36.1	336	342	319	152	793
33	66.8	50.0		76.6	53.3	34.9	327	334	311	149	788
32	66.3	49.2		76.1	52.1	33.7	318	326	301	146	783
31	65.8	48.4	NA	75.6	51.3	32.5	310	318	294	141	778
30	65.3	47.7	92.0	75.0	50.4	31.3	302	311	286	138	773
29	64.6	47.0	91.0	74.5	49.5	30.1	294	304	279	135	768
28	64.3	46.1	90.0	73.9	48.6	28.9	286	297	271	131	762
27	63.8	45.2	89.0	73.3	47.7	27.8	279	290	264	128	757
26	63.3	44.6	88.0	72.8	46.8	26.7	272	284	258	125	751
25	62.8	43.8	87.0	72.2	45.9	25.5	266	278	253	123	746
24	62.4	43.1	86.0	71.6	45.0	24.3	260	272	247	119	741
23	62.0	42.1	84.5	71.0	44.0	23.1	254	266	243	117	736
22	61.5	41.6	83.5	70.5	43.2	22.0	248	261	237	115	730
21	61.0	40.9	82.5	69.9	42.3	20.7	243	256	231	112	725
20	60.5	40.1	81.0	69.4	41.5	19.6	238	251	226	110	720

Note
1: A 10 mm steel ball was used for 450 BHN and below. A 10 mm carbide ball was used above 450 BHN.
2: The tensile strength relation to hardness is not exact, even for steel, unless it is determined for a specific material.

Cylindrical Correction Chart 53

Cylindrical work corrections to be added to observed Rockwell number for scales indicated

Scales C, D, A
Brale Diamond Indenter
Diameter of Specimen - inches (mm)

Observed Reading	1/8 (3.2)	1/4 (6.4)	3/8 (10)	1/2 (13)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)	1-1/4 (32)	1-1/2 (38)
90	NA	0.5	0	0	0	0	0	0	0	0
85		0.5	0.5	0.5	0	0	0	0	0	0
80		0.5	0.5	0.5	0.5	0.5	0	0	0	0
75		1.0	0.5	0.5	0.5	0.5	0.5	0	0	0
70		1.0	1.0	0.5	0.5	0.5	0.5	0.5	0	0
65		1.5	1.0	1.0	0.5	0.5	0.5	0.5	0	0
60		1.5	1.0	1.0	0.5	0.5	0.5	0.5	0	0
55		2.0	1.5	1.0	1.0	0.5	0.5	0.5	0.5	0
50		2.5	2.0	1.5	1.0	1.0	0.5	0.5	0.5	0.5
45		3.0	2.0	1.5	1.0	1.0	1.0	0.5	0.5	0.5
40		3.5	2.5	2.0	1.5	1.0	1.0	1.0	0.5	0.5
35		4.0	3.0	2.0	1.5	1.5	1.0	1.0	0.5	0.5
30		5.0	3.5	2.5	2.0	1.5	1.5	1.0	1.0	0.5
25		5.5	4.0	3.0	2.5	2.0	1.5	1.0	1.0	1.0
20		6.0	4.5	3.5	2.5	2.0	1.5	1.5	1.0	1.0

Scales B, F, G
1/16-in Ball Indenter
Diameter of Specimen - inches (mm)

Observed Reading	1/8 (3.2)	1/4 (6.4)	3/8 (10)	1/2 (13)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)	1-1/4 (32)	1-1/2 (38)
100	NA	3.5	2.5	1.5	1.5	1.0	1.0	0.5	NA	NA
90		4.0	3.0	2.0	1.5	1.5	1.5	1.0		
80		5.0	3.5	2.5	2.0	1.5	1.5	1.5		
70		6.0	4.0	3.0	2.5	2.0	2.0	1.5		
60		7.0	5.0	3.5	3.0	2.5	2.0	2.0		
50		8.0	5.5	4.0	3.5	3.0	2.5	2.0		
40		9.0	6.0	4.5	4.0	3.0	2.5	2.5		
30		10.0	6.5	5.0	4.5	3.5	3.0	2.5		
20		11.0	7.5	5.5	4.5	4.0	3.5	3.0		
10		12.0	8.0	6.0	5.0	4.0	3.5	3.0		
0		12.5	8.5	6.5	5.5	4.5	3.5	3.0		

Scales 15-N, 30-N, 45-N
N Brale Diamond Indenter
Diameter of Specimen - inches (mm)

Observed Reading	1/8 (3.2)	1/4 (6.4)	3/8 (10)	1/2 (13)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)	1-1/4 (32)	1-1/2 (38)
90	0	0	0	0	0	0	0	0	NA	NA
85	0.5	0.5	0.5	0.5	0	0	0	0		
80	1.0	0.5	0.5	0.5	0.5	0	0	0		
75	1.5	1.0	0.5	0.5	0.5	0.5	0	0		
70	2.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5		
65	2.5	1.5	1.0	0.5	0.5	0.5	0.5	0.5		
60	3.0	1.5	1.0	1.0	1.0	0.5	0.5	0.5		
55	3.5	2.0	1.5	1.0	1.0	0.5	0.5	0.5		
50	3.5	2.0	1.5	1.0	1.0	1.0	1.0	0.5		
45	4.0	2.0	1.5	1.0	1.0	1.0	1.0	1.0		
40	4.5	2.5	1.5	1.5	1.0	1.0	1.0	1.0		
35	5.0	2.5	2.0	1.5	1.0	1.0	1.0	1.0		
30	5.5	3.0	2.0	1.5	1.5	1.0	1.0	1.0		
25	5.5	3.0	2.0	1.5	1.5	1.5	1.5	1.0		
20	6.0	3.0	2.0	1.5	1.5	1.5	1.5	1.5		

Scales 15-T, 30-T, 45-T
1/16-in Ball Indenter
Diameter of Specimen - inches (mm)

Observed Reading	1/8 (3.2)	1/4 (6.4)	3/8 (10)	1/2 (13)	5/8 (16)	3/4 (19)	7/8 (22)	1 (25)	1-1/4 (32)	1-1/2 (38)
90	1.5	1.0	1.0	0.5	0.5	0.5	0.5	0.5	NA	NA
80	3.0	2.0	1.5	1.5	1.0	1.0	1.0	0.5		
70	5.0	3.5	2.5	2.0	1.5	1.0	1.0	1.0		
60	6.5	4.5	3.0	2.5	2.0	1.5	1.5	1.5		
50	8.5	5.5	4.0	3.0	2.5	2.0	2.0	1.5		
40	10.0	6.5	4.5	3.5	3.0	2.5	2.0	2.0		
30	11.5	7.5	5.0	3.5	3.5	2.5	2.0	2.0		
20	13.0	9.0	6.0	4.5	4.5	3.0	2.0	2.0		

These corrections are approximate only and represent the averages to the nearest 1/2 Rockwell number.

Soft Steel, Grey and Malleable Cast Iron and Most Non-Ferrous Metals

Rockwell B	Rockwell F	Rockwell G	Rockwell A	Rockwell E	Rockwell H	Rockwell K	Superficial 15-T	Superficial 30-T	Superficial 45-T	Knoop HK	Brinell HB	Brinell HB HV	Tensile Strength KSI	Micro-ficial WMN
100 kg 1/16" ball	60 kg 1/16" ball	150 kg 1/16" ball	60 kg Brale	100 kg 1/8" ball	60 kg 1/8" ball	150 kg 1/8" ball	15 kg 1/16" ball	30 kg 1/16" ball	45 kg 1/16" ball	500 gm and over	500 kg 10 mm ball	3000 kg 10 kg	1000 lbs/ sq in	1000 gm
100		82.5	61.5				93.1	83.1	72.9	251	201	240	116	730
99		81.0	60.9				92.8	82.5	71.9	246	195	234	114	725
98		79.0	60.2				92.5	81.8	70.9	241	189	228	109	719
97		77.5	59.5				92.1	81.1	69.9	236	184	222	104	713
96		76.0	58.9				91.8	80.4	68.9	231	179	216	102	707
95		74.0	58.3				91.5	79.8	67.9	226	175	210	100	701
94		72.5	57.6				91.2	79.1	66.9	221	171	205	98	696
93		71.0	57.0			NA	90.8	78.4	65.9	216	167	200	94	690
92		69.0	56.4			100	90.5	77.8	64.8	211	163	195	92	684
91		67.5	55.8			99.5	90.2	77.1	63.8	206	160	190	90	679
90		66.0	55.2			98.5	89.9	76.4	62.8	201	157	185	89	674
89		64.0	54.6			98.0	89.5	75.8	61.8	196	154	180	88	668
88		62.5	54.0			97.0	89.2	75.1	60.8	192	151	176	86	662
87		61.0	53.4			96.5	88.9	74.4	59.8	188	148	172	84	656
86		59.0	52.8			95.5	88.6	73.8	58.8	184	145	169	83	651
85		57.5	52.3			94.5	88.2	73.1	57.8	180	142	165	82	646
84		56.0	51.7			94.0	87.9	72.4	56.8	176	140	162	81	640
83		54.0	51.1			93.0	87.6	71.8	55.8	173	137	159	80	634
82		52.5	50.6			92.0	87.3	71.1	54.8	170	135	156	77	629
81		51.0	50.0			91.0	86.9	70.4	53.8	167	133	153	73	624
80		49.0	49.5			90.5	86.6	69.7	52.8	164	130	150	72	618
79		47.5	48.9			89.5	86.3	69.1	51.8	161	128	147	70	612
78		46.0	48.4			88.5	86.0	68.4	50.8	158	126	144	69	607
77		44.0	47.9			88.0	85.6	67.7	49.8	155	124	141	68	602
76	NA	42.5	47.3			87.0	85.3	67.1	48.8	152	122	139	67	596
75	99.6	41.0	46.8			86.0	85.0	66.4	47.8	150	120	137	66	592
74	99.1	39.0	46.3			85.0	84.7	65.7	46.8	147	118	135	65	587
73	98.5	37.5	45.8			84.5	84.3	65.1	45.8	145	116	132	64	581
72	98.0	36.0	45.3	NA		83.5	84.0	64.4	44.8	143	114	130	63	576
71	97.4	34.5	44.8	100		82.5	83.7	63.7	43.8	141	112	127	62	571
70	96.8	32.5	44.3	99.5		81.5	83.4	63.1	42.8	139	110	125	61	566
69	96.2	31.0	43.8	99.0		81.0	83.0	62.4	41.8	137	109	123	60	561
68	95.6	29.5	43.3	98.0		80.0	82.7	61.7	40.8	135	107	121	59	556
67	95.1	28.0	42.8	97.5		79.0	82.4	61.0	39.8	133	106	119	58	551
66	94.5	26.5	42.3	97.0		78.0	82.1	60.4	38.7	131	104	117	57	546
65	93.9	25.0	41.8	96.0		77.5	81.8	59.7	37.7	129	102	116	56	542
64	93.4	23.5	41.4	95.5		76.5	81.4	59.0	36.7	127	101	114	NA	537
63	92.8	22.0	40.9	95.0		75.5	81.1	58.4	35.7	125	99	112		532
62	92.2	20.5	40.4	94.5		74.5	80.8	57.7	34.7	124	98	110		527
61	91.7	19.0	40.0	93.5		74.0	80.5	57.0	33.7	122	96	108		522
60	91.1	17.5	39.5	93.0		73.0	80.1	56.4	32.7	120	95	107		517
59	90.5	16.0	39.0	92.5		72.0	79.8	55.7	31.7	118	94	106		512
58	90.0	14.5	38.6	92.0		71.0	79.5	55.0	30.7	117	92	104		507
57	89.4	13.0	38.1	91.0		70.5	79.2	54.4	29.7	115	91	103		502
56	88.8	11.5	37.7	90.5		69.5	78.8	53.7	28.7	114	90	101		497
55	88.2	10.0	37.2	90.0		68.5	78.5	53.0	27.7	112	89	100		492
54	87.7	8.5	36.8	89.5		68.0	78.2	52.4	26.7	111	87	NA		487
53	87.1	7.0	36.3	89.0		67.0	77.9	51.7	25.7	110	86			482
52	86.5	5.5	35.9	88.0		66.0	77.5	51.0	24.7	109	85			477
51	86.0	4.0	35.5	87.5		65.0	77.2	50.3	23.7	108	84			472
50	85.4	2.5	35.0	87.0		64.5	76.9	49.7	22.7	107	83			468
49	84.8	NA	34.6	86.5		63.5	76.6	49.0	21.7	106	82			463
48	84.3		34.1	85.5		62.5	76.2	48.3	20.7	105	81			458
47	83.7		33.7	85.0		61.5	75.9	47.7	19.7	104	80			453
46	83.1		33.3	84.5		61.0	75.6	47.0	18.7	103	80			448
45	82.6		32.9	84.0		60.0	75.3	46.3	17.7	102	79			444
44	82.0		32.4	83.5		59.0	74.9	45.7	16.7	101	78			439
43	81.4		32.0	82.5		58.0	74.6	45.0	15.7	100	77			435
42	80.8		31.6	82.0		57.5	74.3	44.3	14.7	99	76			430
41	80.3		31.2	81.5		56.5	74.0	43.7	13.6	98	75			426
40	79.7		30.7	81.0		55.5	73.6	43.0	12.6	97	75			422
39	79.1		30.3	80.0		54.5	73.3	42.3	11.6	96	74			417
38	78.6		29.9	79.5		54.0	73.0	41.6	10.6	95	73			413
37	78.0		29.5	79.0	NA	53.0	72.7	41.0	9.6	94	72			409
36	77.4		29.1	78.5	100	52.0	72.3	40.3	8.6	93	72			404
35	76.9		28.7	78.0	99.5	51.5	72.0	39.6	7.6	92	71			401
34	76.3		28.2	77.0	99.0	50.5	71.7	39.0	6.6	91	70			396
33	75.7		27.8	76.5	98.8	49.5	71.4	38.3	5.6	90	69			392
32	75.2		27.4	76.0	98.5	48.5	71.0	37.6	4.6	89	69			388
31	74.6		27.0	75.5	98.0	48.0	70.7	37.0	3.6	88	68		NOTE 2	384
30	74.0		26.6	75.0	97.8	47.0	70.4	36.3	2.6	87	67			380
29	73.5		26.0	74.0	97.5	46.0	70.0	35.6	1.0	87	66			376
28	73.0		25.5	73.5	97.0	45.0	69.3	34.5	NA	86	66			372
27	72.5		25.0	73.0	96.5	44.5	69.5	34.0		85	65			369
26	72.0		24.5	72.5	96.3	43.5	69.0	33.0		84	65			365
25	71.0		24.3	72.0	96.0	42.5	68.8	32.5		83	64			361
24	70.5		24.0	71.0	95.5	41.5	68.5	32.0		82	64			357
23	70.0		23.5	70.5	95.3	41.0	68.0	31.0		82	63			353
22	69.5		23.0	70.0	95.0	40.0	67.8	30.5		81	62			350
21	69.0		22.5	69.5	94.5	39.0	67.5	29.5		81	62			346
20	68.5		22.0	68.5	94.3	38.0	67.3	29.0		80	61			343
19	68.0		21.5	68.0	94.0	37.5	67.0	28.5		79	61			339
18	67.0		21.3	67.5	93.5	36.5	66.5	27.5		78	60			335
17	66.5		21.0	67.0	93.0	35.5	66.3	27.0		78	60			332
16	66.0		20.5	66.5	92.8	35.0	66.0	26.0		77	59			329
15	65.5		20.0	65.5	92.5	34.0	65.5	25.5		76	59			325
14	65.0		NA	65.0	92.0	33.0	65.3	25.0		75	59			322
13	64.5			64.5	91.8	32.0	65.0	24.0		75	58			318
12	64.0			64.0	91.5	31.5	64.5	23.5		74	58			314
11	63.5			63.5	91.0	30.5	64.3	23.0		73	57			311
10	63.0			62.5	90.5	29.5	64.0	22.0		72	57			308
9	62.0			62.0	90.3	29.0	63.8	21.5		71	57			304
8	61.5			61.5	90.0	28.0	63.5	20.5		71	56			300
7	61.0			61.0	89.5	27.0	63.0	20.0		70	56			297
6	60.5			60.5	89.3	26.0	62.8	19.5		69	55			293
5	60.0			60.0	89.0	25.5	62.5	18.5		69	55			289
4	59.5			59.0	88.5	24.5	62.0	18.0		69	55			286
3	59.0			58.5	88.0	23.5	61.8	17.0		68	54			283
2	58.0			58.0	87.8	23.0	61.5	16.5		68	54			279
1	57.5			57.5	87.5	22.0	61.0	16.0		63	54			276
0	57.0			57.0	87.0	21.0	60.5	15.0		63	53			272

The values shown are approximate only. This chart is intended primarily as a reference guide.

Hardness vs Minimum Thickness Chart 55

Any greater thickness and hardness can be safely tested on indicated scale	Rockwell Superficial Hardness Scales			Rockwell Regular Hardness Scales		
	15N	30N	45N	A	D	C
	15 kgf	30 kgf	45 kgf	60 kgf	100 kgf	150 kgf
Thickness inches (mm)	N Brale Indenter			Brale Indenter		
.006 (0.15)	92	-	-	-	-	-
.008 (0.20)	90	-	-	-	-	-
.010 (0.25)	88	-	-	-	-	-
.012 (0.30)	83	82	77	-	-	-
.014 (0.36)	76	78.5	74	-	-	-
.016 (0.41)	68	74	72	86	-	-
.018 (0.46)	×	66	68	84	-	-
.020 (0.51)	×	57	63	82	77	-
.022 (0.56)	×	47	58	79	75	69
.024 (0.61)	×	×	51	76	72	67
.026 (0.66)	×	×	37	71	68	65
.028 (0.71)	×	×	20	67	63	62
.030 (0.76)	×	×	×	60	58	57
.032 (0.81)	×	×	×	×	51	52
.034 (0.86)	×	×	×	×	43	45
.036 (0.91)	×	×	×	×	×	37
.038 (0.96)	×	×	×	×	×	28
.040 (1.02)	×	×	×	×	×	20
Any greater thickness and hardness can be safely tested on indicated scale	Rockwell Superficial Hardness Scales			Rockwell Regular Hardness Scales		
	15-T	30-T	45-T	F	B	G
	15 kgf	30 kgf	45 kgf	60 kgf	100 kgf	150 kgf
Thickness inches (mm)	1/16-in Ball Indenter			1/16-in Ball Indenter		
.010 (0.25)	91	-	-	-	-	-
.012 (0.30)	86	-	-	-	-	-
.014 (0.36)	81	80	-	-	-	-
.016 (0.41)	75	72	71	-	-	-
.018 (0.46)	68	64	62	-	-	-
.020 (0.51)	×	55	53	-	-	-
.022 (0.56)	×	45	43	-	-	-
.024 (0.61)	×	34	31	98	94	94
.026 (0.66)	×	×	18	91	87	87
.028 (0.71)	×	×	4	85	80	76
.030 (0.76)	×	×	×	77	71	68
.032 (0.81)	×	×	×	69	62	59
.034 (0.86)	×	×	×	×	52	50
.036 (0.91)	×	×	×	×	40	42
.038 (0.96)	×	×	×	×	28	31
.040 (1.02)	×	×	×	×	×	22

X = No minimum hardness. These are approximate numbers only.

Conversions

All values, except WMN, are consistent with ASTM E140 Tables 1 and 2, and ASTM A370 Tables 3A and 3B, where applicable. WMN or Wilson Microficial Numbers were developed by Wilson Instruments in the Wilson Standards laboratory and are not derived from ASTM.

Cylindrical Corrections Values are consistent with ASTM E18 Table 6,7,13, and 14 Hardness vs. Minimum Thickness Values are consistent with ASTM E18 Tables 4, 5, 11, and 12 except for D and G scale values, which are obtained from indentation hardness testing by Vincent E. Lysaght.

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