

HARDENED STEEL AND HARD ALLOYS

Rockwell [®]				Superficial			Vickers	Knoop	Brinell	Tensile Strength	Micro-ficial
C	A	D	G	15-N	30-N	45-N	HV	HK	HB	KSI	WMMN
150 kg Brale ^a	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	-	NOTE 1	NOTE 2	-
71	87.0	79.5	.....	94.3	86.5	78.5	1160	-	.....	.....	-
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	.....	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 inexact, even for steel, unless it is determined for a specific material.

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)	X	66	68	84	-	-
.020 (0.51)	X	57	63	82	77	-
.022 (0.56)	X	47	58	79	75	69
.024 (0.61)	X	X	51	76	72	67
.026 (0.66)	X	X	37	71	68	65
.028 (0.71)	X	X	20	67	63	62
.030 (0.76)	X	X	X	60	58	57
.032 (0.81)	X	X	X	X	51	52
.034 (0.86)	X	X	X	X	43	45
.036 (0.91)	X	X	X	X	X	37
.038 (0.96)	X	X	X	X	X	28
.040 (1.02)	X	X	X	X	X	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)	X	55	53	-	-	-
.022 (0.56)	X	45	43	-	-	-
.024 (0.61)	X	34	31	98	94	94
.026 (0.66)	X	X	18	91	87	87
.028 (0.71)	X	X	4	85	80	76
.030 (0.76)	X	X	X	77	71	68
.032 (0.81)	X	X	X	69	62	59
.034 (0.86)	X	X	X	X	52	50
.036 (0.91)	X	X	X	X	40	42
.038 (0.96)	X	X	X	X	28	31
.040 (1.02)	X	X	X	X	X	22

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



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