

AANVULLENDE INFORMATIE OVER HARDHEID

CATALOGUS No. E4104 (NL)
Tabellen etc



- Informatie en materialen
- . Definitie van hardheid
- Relatie tussen het testmateriaal en de minimum dikte
- Hardheid conversie tabel

Informatie en materialen

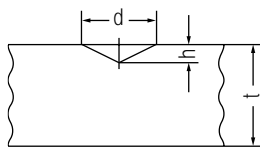
Hardheid normen

JIS	Omschrijving	Hardheid (schaal)
A 1126-01	Test method for content of soft particles in coarse aggregate by scratching	
B 7724-99	Brinell hardness test–Verification of testing machines	HB
B 7725-97	Vickers hardness test–Verification of testing machines	HV
B 7726-97	Rockwell hardness test–Verification of testing machines	HR
B 7727-00	Shore hardness test–Verification of testing machines	HS
B 7728-02	Calibration of force-proving instruments used for the verification of uniaxial testing machines	
B 7730-97	Rockwell hardness test–Calibration of standard blocks	HR
B 7731-00	Shore hardness test–Calibration of standard blocks	HS
B 7734-97	Knoop hardness test–Verification of testing machines	HV, HK
B 7735-97	Vickers hardness test–Calibration of the standard blocks	HV
B 7736-99	Brinell hardness test–Calibration of standard blocks	HB
D 4421-96	Hardness test method for brake linings, pads and clutch facings of automobiles	HRM, HRR, BRS, HRV
G 0557-96	Methods of measuring case depth hardened by carburizing treatment for steel	HV
G 0558-98	Methods of measuring decarburized depth for steel	HV, 15N, 30N
G 0559-96	Methods of measuring case depth for steel hardened by flame or induction hardening process	HV, HRC
G 0561-98	Method of hardenability test for steel (End quenching method)	HV, HRC
G 0562-93	Method of measuring nitrided case depth for iron and steel	HV, HK
G 0563-93	Method of measuring surface hardness for nitrided iron and steel	HV, HK, HR15N, HS
H 0511-90	Testing Methods for Brinell Hardness of Titanium Sponge	HB
K 6250-01	General Rules of Physical Testing methods for Vulcanized Rubber and Thermoplastic Rubber	A, D
K 6253-97	Hardness testing methods for rubber, vulcanized or thermoplastic	A, D
K 7060-95	Testing method for barcol hardness of glass fiber reinforced plastics	
K 7202-2-01	Plastics - Determination of hardness - Part 2: Rockwell hardness	HRR, HRL, HRM, HRE
K 7215-86	Testing Methods for Durometer Hardness of Plastics	HDA, HDD
R 1607-95	Testing methods for fracture toughness of fine ceramics	Kc
S 6050-02	Plastics erasers	
Z 2101-94	Test methods for wood	HB
Z 2243-98	Brinell hardness test - Test method	HB
Z 2244-03	Vickers hardness test - Test method	HV
Z 2245-05	Rockwell hardness test - Test method	HR
Z 2246-00	Shore hardness test–Test method	HS
Z 2251-98	Knoop hardness test–Test method	HV, HK
Z 2252-91	Test methods for Vickers hardness at elevated temperatures	HV
Z 3101-90	Testing Method of Maximum Hardness in Weld Heat - Affected Zone	HV
Z 3114-90	Method of Hardness Test for Deposited Metal	HV, HRB, HRC
Z 3115-73	Method of Taper Hardness Test in Weld Heat - Affected Zone	HV

Opmerking: De norm nummers en omschrijvingen kunnen in verband met voortdurende ontwikkelingen en verbeteringen verschillen.

Relatie tussen het testmateriaal en de minimum materiaal dikte

Vickers

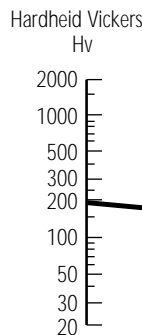


$$HV = 0.1891 \frac{F}{d^2}$$

$$t > 1.5d$$

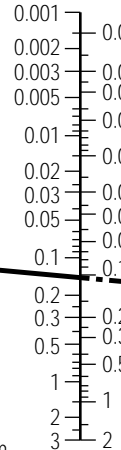
$$h = \frac{d}{7}$$

t: Dikte van het testmateriaal mm
d: Lengte van de diagonale lijn mm
h: Indruk diepte mm



Minimum dikte van het testmateriaal
t: mm

Diagonale lengte van het indruklichaam
d: mm

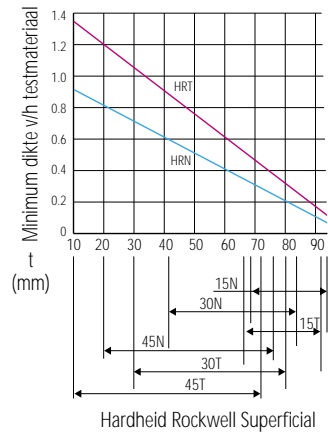
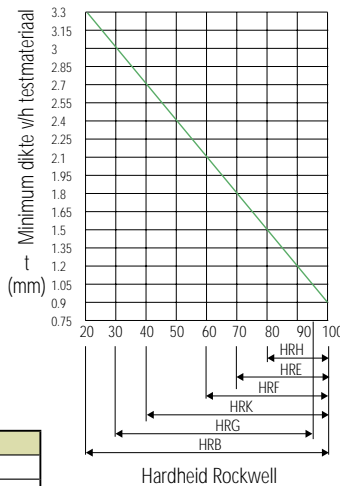
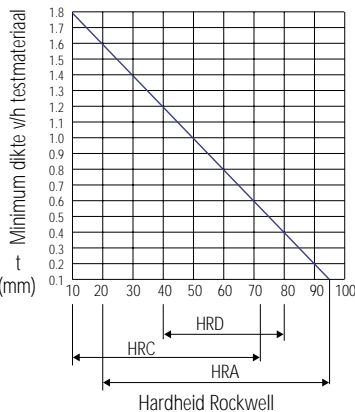


Hardheid schaal Test belasting
HV 0.0005 F: N

0.001	4.903 X 10 ⁻³
0.002	9.807 X 10 ⁻³
0.003	19.61 X 10 ⁻³
0.005	29.42 X 10 ⁻³
0.01	49.03 X 10 ⁻³
0.02	98.07 X 10 ⁻³
0.03	0.1961
0.05	0.2942
0.1	0.4903
0.2	0.9807
0.3	1.961
0.5	2.942
1	4.903
2	9.807
3	19.61
5	29.42
10	49.03
20	98.07
30	196.1
50	294.2
100	490.3

[Voorbeeld]
t: Dikte van het testmateriaal: 0.15mm
Hardheid van het testmateriaal: 185HV1
d: Lengte van de diagonale lijn: 0,1mm
h: Indruk diepte: mm
F: Test belasting

Rockwell Rockwell Superficial



Hardheid Rockwell schalen

Schaal	Indruklichaam	Test Kracht	Materiaal
A		60kgf (588.4N)	Hardmetaal
B	Diamant	100kgf (980.7N)	Gehard staal
C		150kgf (1471N)	Staal (100HRB of meer tot 70HRC of minder)
F	Kogel van 1.5875mm in diameter (1/16")	60kgf (588.4N)	Lagermetalen, gegloeid koper
B		100kgf (980.7N)	Messing
G		150kgf (1471N)	Harde aluminium legeringen, Beryllium koper, Fosforbrons
H	Kogel van 3.175mm in diameter (1/8")	60kgf (588.4N)	Lagermetalen, Slijstenen
E		100kgf (980.7N)	Lagermetalen
K		150kgf (1471N)	Lagermetalen
L	Kogel van 6.35mm in diameter (1/4")	60kgf (588.4N)	Kunststoffen / Plastische materialen, Lood
M		100kgf (980.7N)	
P		150kgf (1471N)	
R	Kogel van 12.7mm in diameter (1/2")	60kgf (588.4N)	Kunststoffen / Plastische materialen, Lood
S		100kgf (980.7N)	
V		150kgf (1471N)	

Schaal	Indruklichaam	Test Kracht	Materiaal
15-N		15kgf (147.1N)	
30-N	Diamant	30kgf (294.2N)	Dunne metalen oppervlakte lagen zoals carboneren en nitreren
45-N		45kgf (441.3N)	
15-T	Kogel van 1.5875mm in diameter (1/16")	15kgf (147.1N)	Plaat of zacht staal, Messing, Brons, etc.
30-T		30kgf (294.2N)	
45-T		45kgf (441.3N)	
15-W	Kogel van 3.175mm in diameter (1/8")	15kgf (147.1N)	Kunststoffen, Zink en lagerlegeringen
30-W		30kgf (294.2N)	
45-W		45kgf (441.3N)	
15-X	Kogel van 6.35mm in diameter (1/4")	15kgf (147.1N)	Kunststoffen, Zink en lagerlegeringen
30-X		30kgf (294.2N)	
45-X		45kgf (441.3N)	
15-Y	Kogel van 12.7mm in diameter (1/2")	15kgf (147.1N)	Kunststoffen, Zink en lagerlegeringen
30-Y		30kgf (294.2N)	
45-Y		45kgf (441.3N)	

Hardheid conversie tabel

Deze tabel wordt gebruikt als conversie en vergelekt bij benadering de verschillende hardheidswaarden die verkregen zouden worden bij het testen van hetzelfde werkstuk met verschillende hardheidsmethodes.

Vanwege het grote verschil in beoordelings methodes , verdient de beoordelings methode zoals in de productspecificatie staat vermeld altijd de voorkeur voor de hoogst mogelijke nauwkeurigheid.

*Deze conversie tabel is samengesteld volgens de SAEJ417 norm. *Hardheid Shore is gebaseerd op de norm JIS B7731.

•Staal

Vickers	Rockwell				Rockwell Superficial			Shore	Brinell
	HV	HRA	HRB	HRC	HRD	15N	30N		
940	85.6	-	68.0	76.9	93.2	84.4	75.4	98.0	-
920	85.3	-	67.5	76.5	93.0	84.0	74.8	96.8	-
900	85.0	-	67.0	76.1	92.9	83.6	74.2	95.6	-
880	84.7	-	66.4	75.7	92.7	83.1	73.6	94.3	-
860	84.4	-	65.9	75.3	92.5	82.7	73.1	93.1	-
840	84.1	-	65.3	74.8	92.3	82.2	72.2	91.7	-
820	83.8	-	64.7	74.3	92.1	81.7	71.8	90.4	733
800	83.4	-	64.0	73.8	91.8	81.1	71.0	89.0	722
780	83.0	-	63.3	73.3	91.5	80.4	70.2	87.6	710
760	82.6	-	62.5	72.6	91.2	79.7	69.4	86.2	697
740	82.2	-	61.8	72.1	91.0	79.1	68.6	84.8	684
720	81.8	-	61.0	71.5	90.7	78.4	67.7	83.3	670
700	81.3	-	60.1	70.8	90.3	77.6	66.7	81.8	656
690	81.1	-	59.7	70.5	90.1	77.2	66.2	81.0	648
680	80.8	-	59.2	70.1	89.8	76.8	65.7	80.2	639
670	80.6	-	58.8	69.8	89.7	76.4	65.3	79.4	360
660	80.3	-	58.3	69.4	89.5	75.9	64.7	78.6	621
650	80.0	-	57.8	69.0	89.2	75.5	64.1	77.8	612
640	79.8	-	57.3	68.7	89.0	75.1	63.5	77.0	602
630	79.5	-	56.8	68.3	88.8	74.6	63.0	76.2	592
620	79.2	-	56.3	67.9	88.5	74.2	62.4	75.4	583
610	78.9	-	55.7	67.5	88.2	73.6	61.7	74.5	574
600	78.6	-	55.2	67.0	88.0	73.2	61.2	73.7	565
590	78.4	-	54.7	66.7	87.8	72.7	60.5	72.8	555
580	78.0	-	54.1	66.2	87.5	72.1	59.9	72.0	546
570	77.8	-	53.6	65.8	87.2	71.7	59.3	71.1	536
560	77.4	-	53.0	65.4	86.9	71.2	58.6	70.2	525
550	77.0	-	52.3	64.8	86.6	70.5	57.8	69.3	517
540	76.7	-	51.7	64.4	86.3	70.0	57.0	68.4	508
530	76.4	-	51.1	63.9	86.0	69.5	56.2	67.5	498
520	76.1	-	50.5	63.5	85.7	69.0	55.6	66.6	488
510	75.7	-	49.8	62.9	85.4	68.3	54.7	65.6	479
500	75.3	-	49.1	62.2	85.0	67.7	53.9	64.7	470
490	74.9	-	48.4	61.6	84.7	67.1	53.1	63.7	461
480	74.5	-	47.7	61.3	84.3	66.4	52.2	62.8	451
470	74.1	-	46.9	60.7	83.9	65.7	51.3	61.8	442
460	73.6	-	46.1	60.1	83.6	64.9	50.4	60.8	434
450	73.3	-	45.3	59.4	83.2	64.3	49.4	59.8	425
440	72.8	-	44.5	58.8	82.8	63.5	48.4	58.8	415
430	72.3	-	43.6	58.2	82.3	62.7	47.4	57.8	405
420	71.8	-	42.7	57.5	81.8	61.9	46.4	56.7	397
410	71.4	-	41.8	56.8	81.4	61.1	45.3	55.7	388
400	70.8	-	40.8	56.0	81.0	60.2	44.1	54.6	379
390	70.3	-	39.8	55.2	80.3	59.3	42.9	53.6	369
380	69.8	(110.0)	38.8	54.4	79.8	58.4	41.7	52.5	360
370	69.2	-	37.7	53.6	79.2	57.4	40.4	51.4	350
360	68.7	(109.0)	36.6	52.8	78.6	56.4	39.1	50.3	341
350	68.1	-	35.5	51.9	78.0	55.4	37.8	49.2	331
340	67.36	(108.0)	34.4	51.1	77.4	54.4	36.5	48.1	322
330	67.0	-	33.3	50.2	76.8	53.6	35.2	46.9	313
320	66.4	(107.0)	32.2	49.4	76.2	52.3	33.9	45.7	303
310	65.8	-	31.0	48.4	75.6	51.3	32.5	44.6	294
300	65.2	(105.5)	29.8	47.5	74.9	50.2	31.1	43.4	284
295	64.8	-	29.2	47.1	74.6	49.7	30.4	42.8	280
290	64.5	(104.5)	28.5	46.5	74.2	49.0	29.5	42.2	275
285	64.2	-	27.8	46.0	73.8	48.4	27.7	41.6	270
280	63.8	(103.5)	27.1	45.3	73.4	47.8	27.9	41.0	265
275	63.5	-	26.4	44.9	73.0	47.2	27.1	40.4	261
270	63.1	(102.0)	25.6	44.3	72.6	46.4	26.2	39.7	256
265	62.7	-	24.8	43.7	72.1	45.7	25.2	39.1	252
260	62.4	(101.0)	24.0	43.1	71.6	45.0	24.3	38.5	247
255	62.0	-	23.1	42.2	71.1	44.2	23.2	37.9	243
250	61.6	99.5	22.2	41.7	70.6	43.4	22.2	37.2	238
245	61.2	-	21.3	41.1	70.1	42.5	21.1	36.6	233
240	60.7	98.1	20.3	40.3	69.6	41.7	19.9	36.0	228
230	-	96.7	(18.0)	-	-	-	-	34.7	219
220	-	95.0	(15.7)	-	-	-	-	33.4	209
210	-	93.4	(13.4)	-	-	-	-	32.0	200
200	-	91.5	(11.0)	-	-	-	-	30.7	190
190	-	89.5	(8.5)	-	-	-	-	29.4	181
180	-	87.1	(5.0)	-	-	-	-	28.0	171
170	-	85.0	(3.0)	-	-	-	-	26.6	162
160	-	81.7	(0.0)	-	-	-	-	25.2	152
150	-	78.7	-	-	-	-	-	23.8	143
140	-	75.0	-	-	-	-	-	22.3	133
130	-	71.2	-	-	-	-	-	20.8	124
120	-	66.7	-	-	-	-	-	19.4	114
110	-	62.3	-	-	-	-	-	17.9	105
100	-	56.2	-	-	-	-	-	16.3	95

•Zacht staal, koper legeringen

Vickers	Rockwell		Rockwell Superficial	
	HV	HRB	HRF	30T 45T
196	93.5	110.0	77.5	66.0
194	-	109.5	-	65.5
192	93.0	-	77.0	65.0
190	92.5	109.0	76.5	64.5
188	92.0	-	-	64.0
186	91.5	108.5	76.0	63.5
184	91.0	-	75.5	63.0
182	90.5	108.0	-	62.5
180	90.0	107.5	75.0	62.0
178	89.0	-	74.5	61.5
176	88.5	107.0	-	61.0
174	88.0	-	74.0	60.5
172	87.5	106.5	73.5	60.0
170	87.0	-	-	59.5
168	86.0	106.0	73.0	59.0
166	85.5	-	72.5	58.5
164	85.0	105.5	72.0	58.0
162	84.0	105.0	-	57.5
160	83.5	-	71.5	56.5
158	83.0	104.5	71.0	56.0
156	82.0	104.0	70.5	55.5
154	81.5	103.5	70.0	54.5
152	80.5	103.0	-	54.0
150	80.0	-	69.5	53.5
148	79.0	102.5	96.0	53.0
146	78.0	102.0	68.5	52.5
144	77.5	101.5	68.0	51.5
142	77.0	101.0	67.5	51.0
140	76.0	100.5	67.0	50.0
138	75.0	100.0	66.5	49.0
136	74.5	99.5	66.0	48.0
134	73.5	99.0	65.5	47.5
132	73.0	98.5	65.0	46.5
130	72.0	98.0	64.5	45.5
128	74.0	97.5	63.5	45.0
126	70.0	97.0	63.0	44.0
124	69.0	96.5	62.5	43.0
122	68.0	96.0	62.0	42.0
120	67.0	95.5	61.0	41.0
118	66.0	95.0	60.5	40.0
116	65.0	94.5	60.0	39.0
114	64.0	94.0	59.5	38.0
112	63.0	93.0	58.5	37.0
110	62.0	92.6	58.0	35.5
108	61.0	92.0	57.0	34.5
106	59.5	91.2	56.0	33.0
104	58.0	90.5	55.0	32.0
102	57.0	89.8	54.5	30.5
100	56.0	89.0	53.5	29.5
98	54.0	88.0	52.5	28.0
96	53.0	87.2	51.5	26.5
94	51.0	86.3	50.5	24.5
92	49.5	85.4	49.0	23.0
90	47.5	84.4	48.0	21.0
88	46.0	83.5	47.0	19.0
86	44.0	82.3	45.5	17.0
84	42.0	81.2	44.0	14.5
82	40.0	80.0	43.0	12.5
80	37.5	78.6	41.0	10.0
78	35.0	77.4	39.5	7.5
76	32.5	76.0	38.0	4.5
74	30.0	74.8	36.0	1.0
72	27.5	73.2	34.0	-
70	24.5	71.8	32.0	-
68	21.5	70.0	30.0	-
66	18.5	68.5	28.0	-
64	15.5	66.8	25.5	-
62	12.5	65.0	23.0	-
60	10.0	63.0	20.5	-
58	-	61.0	18.0	-
56	-	58.8	15.0	-
54	-	56.5	12.0	-
52	-	53.5	-	-
50	-	50.5	-	-
49	-	49.0	-	-
48	-	47.0	-	-
47	-	45.0	-	-
46	-	43.0	-	-
45	-	40.0	-	-



Microhardness testing machines
HM-100 Series



Micro surface material property evaluation system
MZT-500 Series



Vickers hardness testing machine
AVK-C0, HV-100 Series



Rockwell hardness testing machine
AR, ARK, ATK, HR Series



Brinell hardness testing machine ABK-1



Shore hardness testing machine ASH Series



Hardmatic HH-411
(Rebound type portable hardness tester)



Hardmatic HH-300 Series (Hardness tester
for sponge, rubber, and plastic)

Coördinatenmeetmachines	
Beeldverwerkingssystemen	
Vorm meetsystemen	
Optisch meten	
Laser Scan Micrometer	
Test Instrumenten en Seismometer	
Digitale lengtemeetsystemen	
Handmeetgereedschappen en gegevensverwerking	

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