

METODI DI PROVA DELLA DUREZZA

Mitutoyo

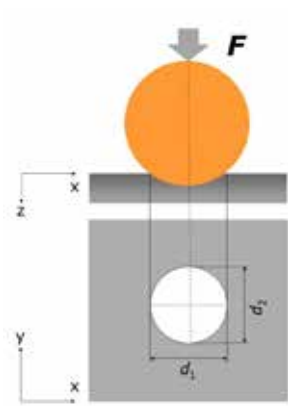
Pacchetto
formazione

Brinell EN ISO 6506

HBW = costante x $\frac{\text{Carico di prova F}}{\text{superficie dell'indentazione}}$

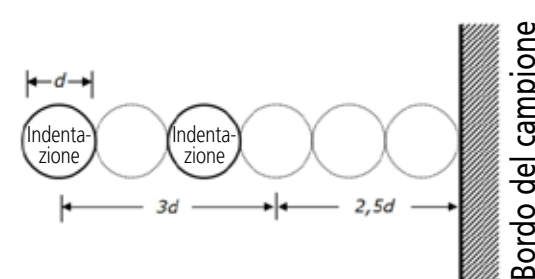
$$HBW = 0,102 \times \frac{\text{Carico di prova F}}{\pi D^2 (1 - \sqrt{1 - d^2/D^2})}$$

$d = \frac{d_1 - d_2}{2}$ diametro medio dell'indentazione
D = diametro della sfera

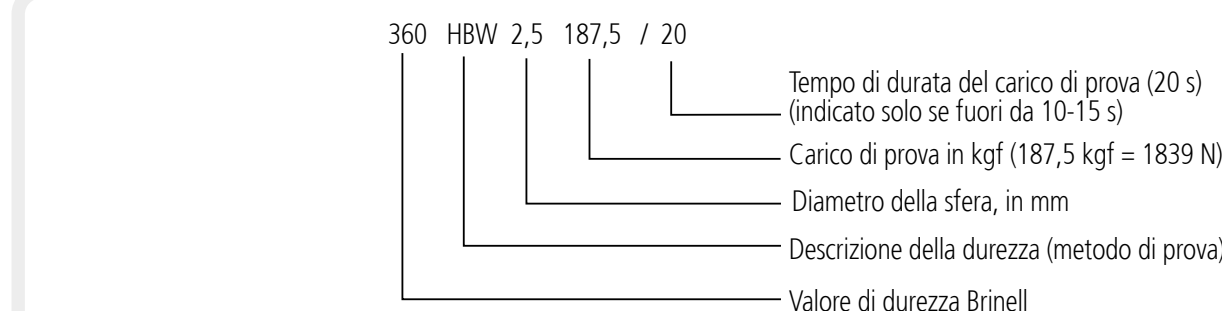


Distanza tra le indentazioni
> 3x diametro indentazione

Distanza dal bordo
> 2,5x diametro indentazione



Simbolo di durezza Scale Brinell	Diametro della sfera D mm	Prova di carico F N	Indice area forza 0,102 x F/D ²	Durezza HBW secondo ISO 6506-4	Materiale/Intervallo come raccomandato in ISO 6506-1
HBW 1/30	1	234,2			
HBW 2,5/187,5	2,5	1839			
HBW 5/350	5	7355			
HBW 10/5000	10	29420			
HBW 10/1500	10	14710			
HBW 1/10	1	98,07			
HBW 2,5/62,5	2,5	612,9			
HBW 5/250	5	2452			
HBW 10/1000	10	9807			
HBW 1/5	1	49,03			
HBW 2,5/125	2,5	306,5			
HBW 5/125	5	1226			
HBW 10/500	10	4903			
HBW 1/2,5	1	24,52			
HBW 2,5/125	2,5	153,2			
HBW 5/62,5	5	612,9			
HBW 10/250	10	2452			
HBW 1/1	1	9,807			
HBW 2,5/62,5	2,5	61,29			
HBW 5/25	5	245,2			
HBW 10/100	10	980,7			

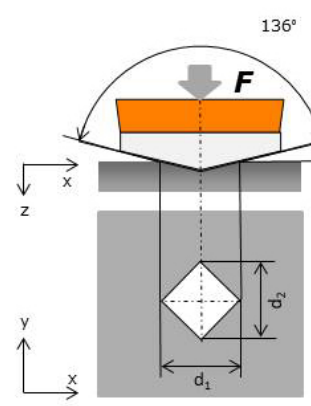


Vickers EN ISO 6507

HV = $\frac{\text{Carico di prova F}}{\text{superficie dell'indentazione}}$

$$HV = 0,102 \times \frac{2F \sin \frac{136^\circ}{2}}{d^2} = 0,1891 \times \frac{F}{d^2}$$

$d = \frac{d_1 - d_2}{2}$ lunghezza diagonale media

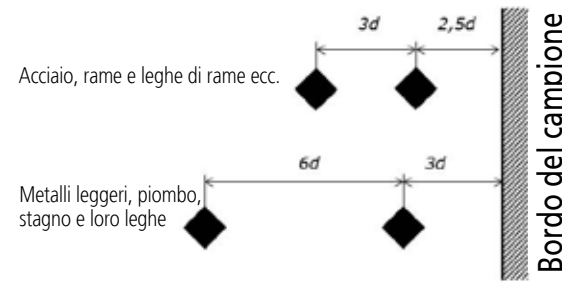


Distanza tra le indentazioni (centro)

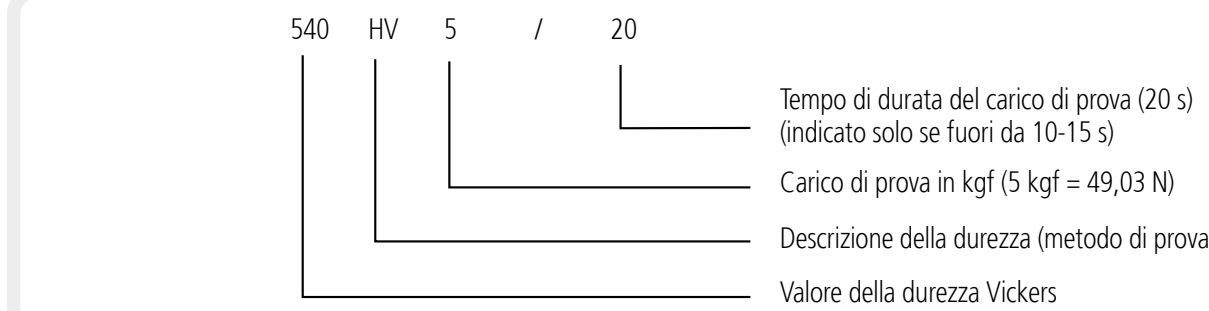
> Distanza minima 3,0x diagonale indentazione per acciaio ecc.
> Distanza minima 6,0x diagonale indentazione per piombo ecc.

Distanza dal centro dell'indentazione al bordo del campione

> Distanza minima 2,5x diagonale indentazione per acciaio ecc.
> Distanza minima 3,0x diagonale indentazione per piombo ecc.

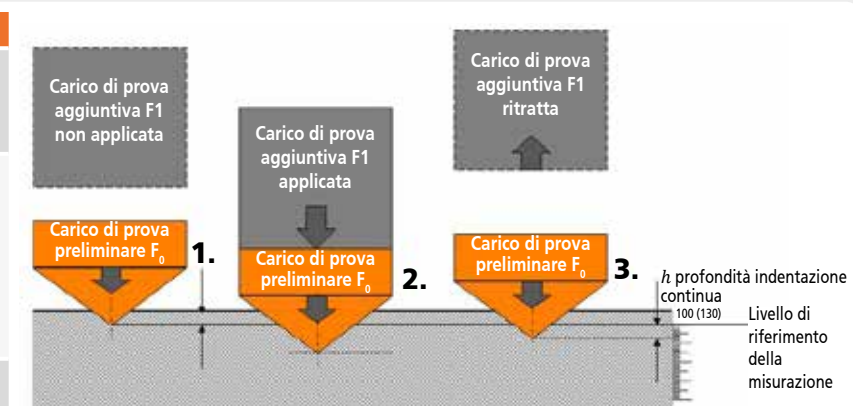


Intervallo del carico di prova	Simbolo di durezza	Valore nominale del carico di prova F	Penetratore	Applicazioni	Intervallo di durezza
Microdurezza test	HV 0,001	0,009 807	Piramide diamantata 136°	Microstrutture, strati molto sottili di materiali, materiali ceramici, profondità di tempra HV0,1: CHD NHD SHD	Lunghezza diagonale da 1 HV a 3000 HV > 20 µm
	HV 0,002	0,019 61			
	HV 0,003	0,029 42			
	HV 0,005	0,049 03			
	HV 0,01	0,098 07			
	HV 0,015	0,147			
	HV 0,02	0,196 1			
	HV 0,025	0,245 2			
	HV 0,05	0,490 3			
	HV 0,1	0,980 7			
Test di durezza a bassa forza	HV 0,2	1,961	Piramide diamantata 136°	Strati sottili di materiale, lamiera, minuteria generica, profondità di tempra: CHD NHD SHD, durezza superficiale, test di saldatura	
	HV 0,3	2,942			
	HV 0,5	4,903			
	HV 1	9,807			
	HV 2	19,61			
	HV 3	29,42			
	HV 5	49,03			
	HV 10	98,07			
	HV 20	196,1			
	HV 30	294,2			
Test di durezza (Macro)	HV 50	490,3	Piramide diamantata 136°	Parti generiche: test di saldatura, parti smezzate, durezza superficiale, test lominy (HV30)	
	HV 100	980,7			



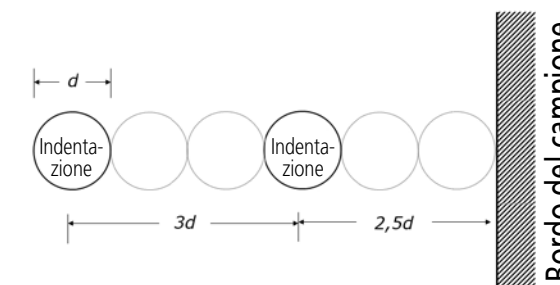
Rockwell EN ISO 6508

Simbolo di durezza	Definizione	
HRA	Durezza standard Rockwell	$100 - \frac{h}{0,002}$
HRC		
HRD		
HRBW		
HREW		
HRFW	Durezza standard Rockwell	$130 - \frac{h}{0,002}$
HRGW		
HRHW		
HRKW		
HRN	Durezza Rockwell superficiale	$100 - \frac{h}{0,001}$
HRTV		

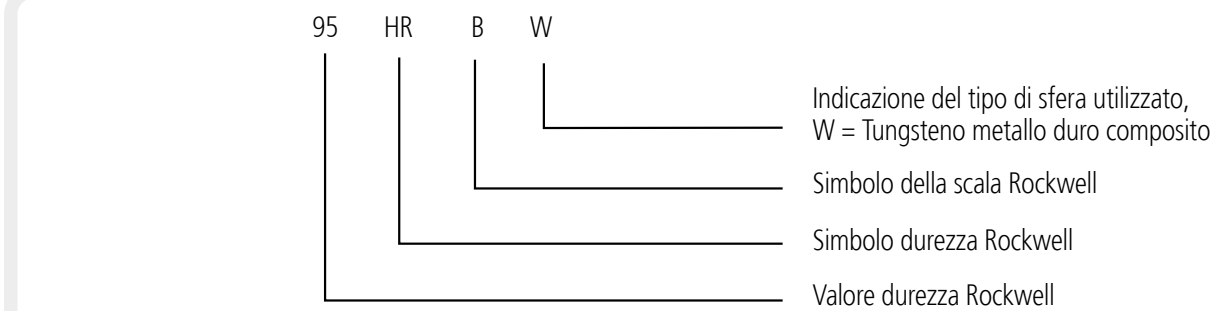


Distanza tra le indentazioni
> 3x diametro indentazione

Distanza dal bordo
> 2,5x diametro indentazione



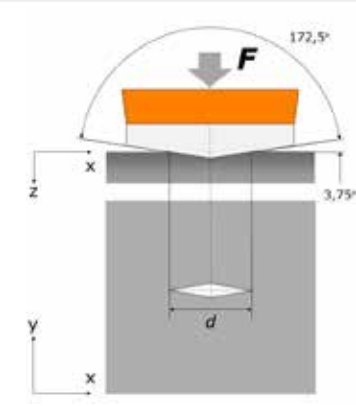
Simbolo di durezza	Penetratore	Forza di prova totale Kgf	Forza di prova totale N	Intervallo di durezza Rockwell applicabile	Intervallo di applicazione
HRA	Diamante	60	588,4	20 - 95 HRA	Metallo duro, lamiera di acciaio
HRD	Diamante	100	980,7	40 - 77 HRD	Acciaio cementato
HRC	Diamante	150	1471	10 - 70 HRC	Acciaio da 100 HRB o più a 70 HRC o meno
HRFW	Sfera da 1,5875 mm	60	588,4	60 - 100 HRFW	Cuscinetti, rame ricotto
HRBW	Sfera da 1,5875 mm	100	980,7	20 - 100 HRBW	Ottone
HRGW	Sfera da 1,5875 mm	150	1471	30 - 94 HRGW	Leghe dure di alluminio, rame berillio, bronzo fosforoso.
HRHW	Sfera da 3,175 mm	60	588,4	80 - 100 HRHW	Metallo per cuscinetti, mole da rettifica
HREW	Sfera da 3,175 mm	100	980,7	70 - 100 HREW	Metallo antiriflesso
HRKW	Sfera da 3,175 mm	150	1471	40 - 100 HRKW	Metallo antiriflesso
HR15N	Diamante	15	147,1	70 - 94 HR15N	
HR30N	Diamante	30	294,2	42 - 86 HR30N	Acciaio con sottile strato superficiale indurito tramite carburazione o nitrurazione
HR45N	Diamante	45	441,3	20 - 77 HR45N	
HR15TW	Sfera da 1,5875 mm	15	147,1	67 - 93 HR15TW	
HR30TW	Sfera da 1,5875 mm	30	294,2	29 - 82 HR30TW	Lamina di acciaio dolce, ottone, bronzo, ecc.
HR45TW	Sfera da 1,5875 mm	45	441,3	10 - 72 HR45TW	



Knoop EN ISO 4545

HK = Costante x $\frac{\text{Carico di prova F}}{\text{superficie dell'indentazione}}$

$$HK = 0,102 \times \frac{2F \tan(\alpha/2)}{d(\beta/\tan)} = 1,451 \times \frac{F}{d^2}$$

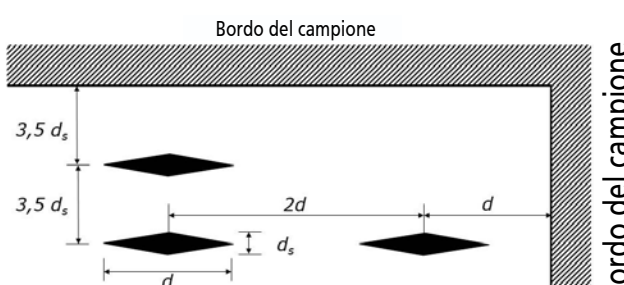


Distanza tra le indentazioni (centro)

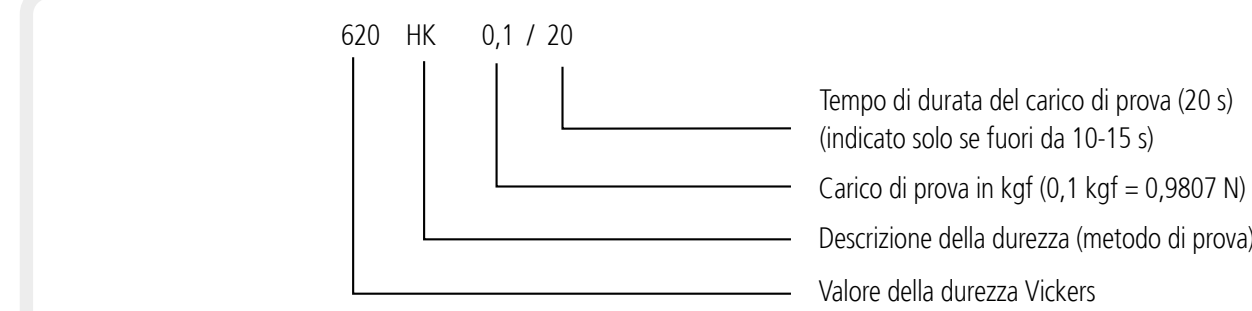
> Lato lungo $\bar{d}$: Distanza minima 2,0x diagonale indentazione $\bar{d}$
> Lato corto $\bar{d}$: Distanza minima 3,5x diagonale indentazione $\bar{d}$

Distanza dal centro dell'indentazione al bordo del campione

> Lato lungo $\bar{d}$: Distanza minima 1,0x diagonale indentazione $\bar{d}$
> Lato corto $\bar{d}$: Distanza minima 3,5x diagonale indentazione $\bar{d}$

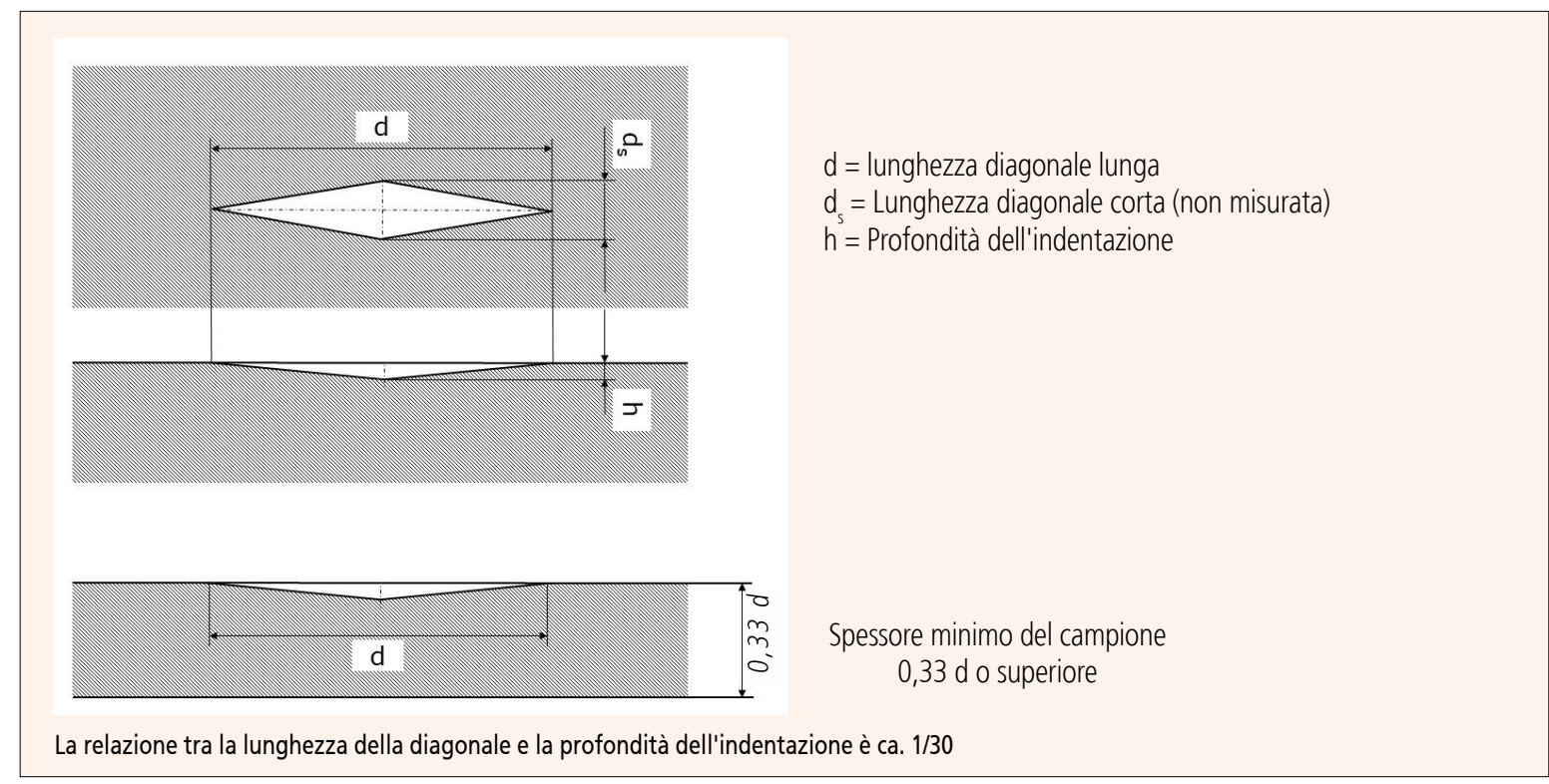
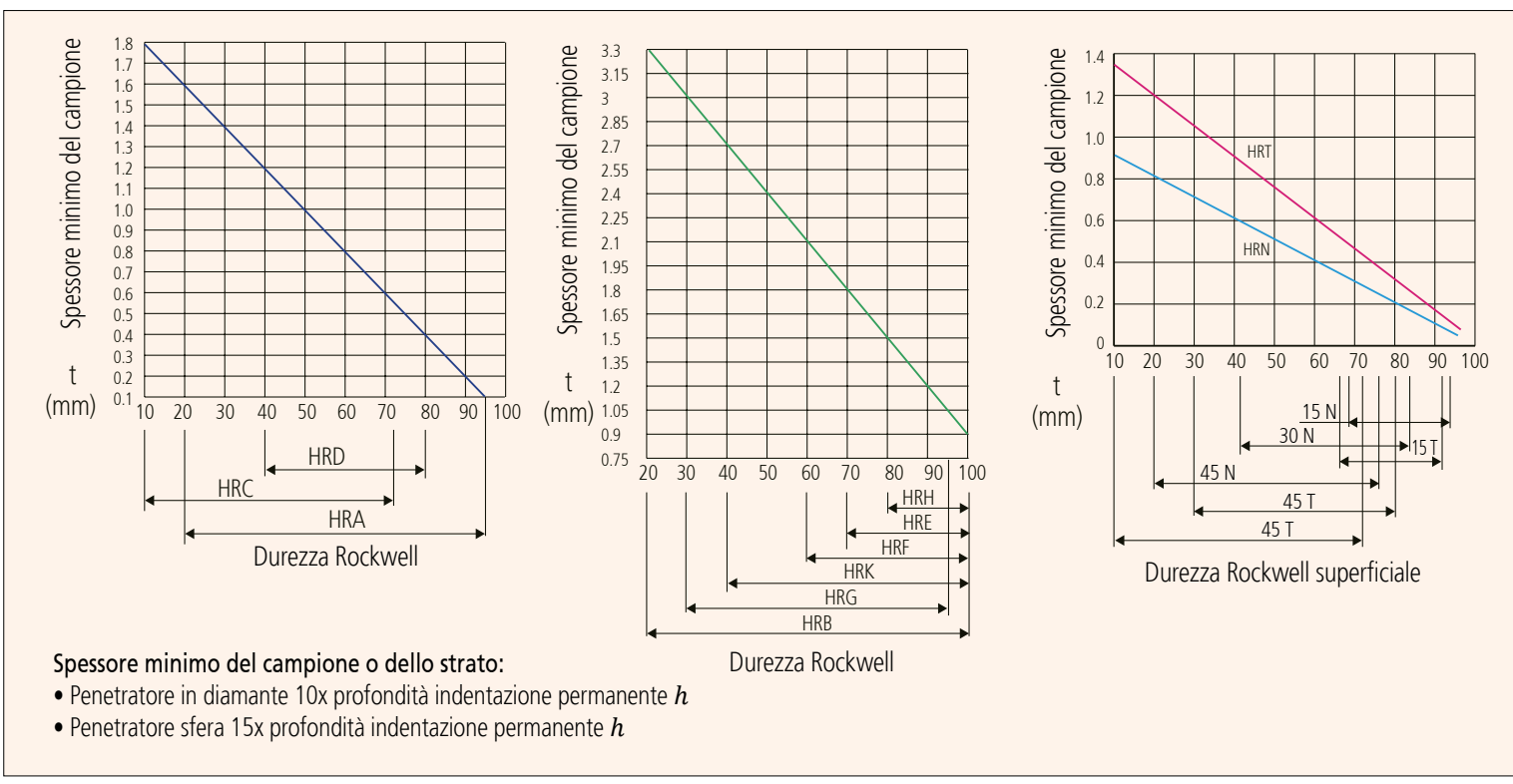
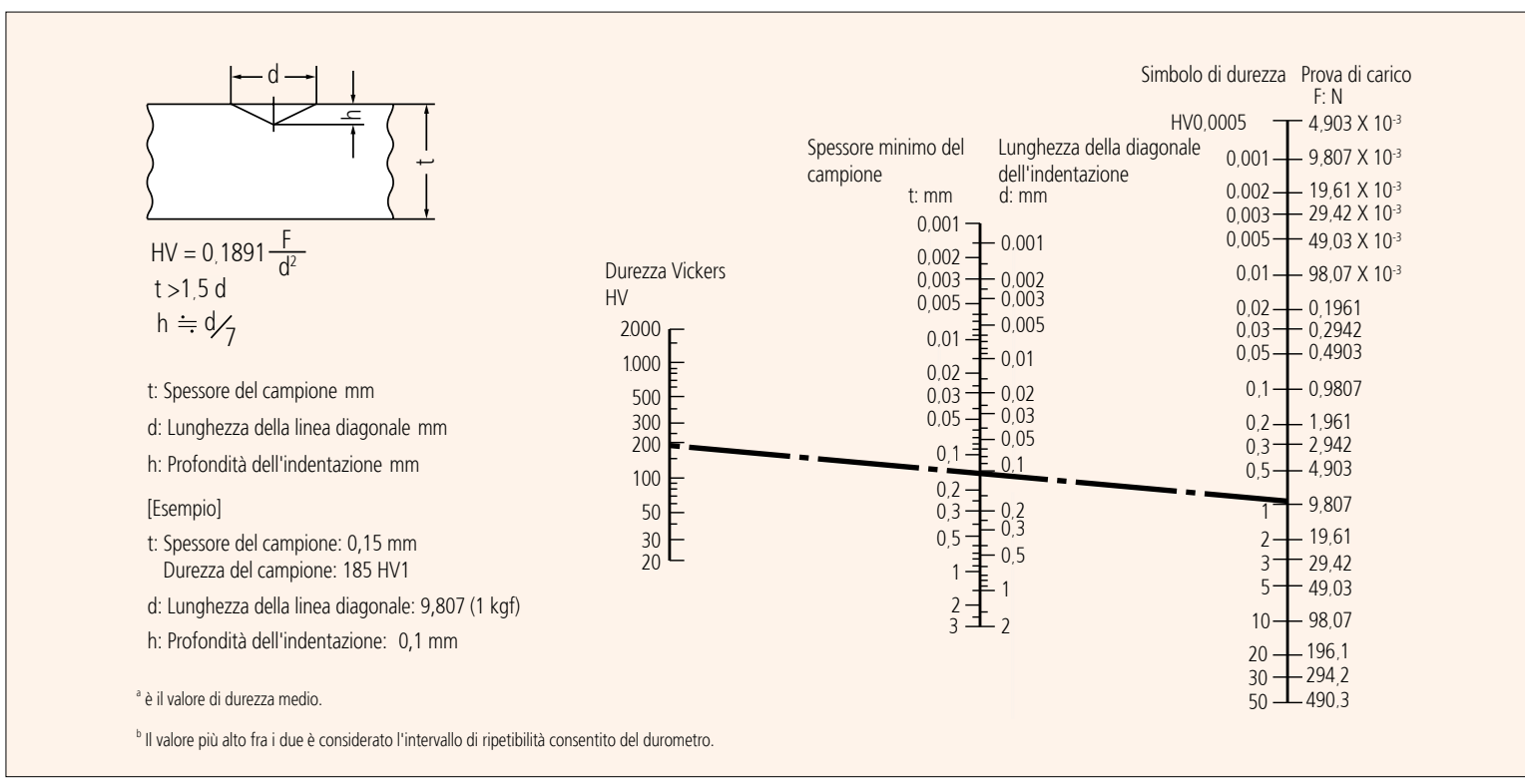


Prova di durezza Knoop		
Simbolo di durezza	Valore nominale della forza di prova F N	Intervallo di applicazione
HK 0,001	0,009807	
HK 0,002	0,01961	
HK 0,005	0,04903	
HK 0,005	0,04903	
HK 0,01	0,09807	
HK 0,02	0,1961	
HK 0,025	0,2452	
HK 0,05	0,4903	
HK 0,1	0,9807	
HK 0,2	1,961	
HK 0,3	2,942	
HK 0,5	4,903	
HK 1	9,807	
HK 2	19,61	



Diametro indentazione medio d	Spessore minimo del campione				Diametro indentazione medio d	Spessore minimo del campione			
	D=1	D=2,5	D=5	D=10		D=1	D=2	D=5	D=10
0,2	0,08				2,4			2,46	1,17
0,3	0,18				2,6			2,92	1,38
0,4	0,33				2,8			3,43	1,6
0,5	0,54				3			4,00	1,84
0,6	0,8	0,29			3,2				2,1
0,7		0,4			3,4				2,38
0,8		0,53			3,6				2,68
0,9		0,67			3,8				3
1		0,83			4				3,34
1,1		1,02			4,2				3,7
1,2		1,23	0,58		4,4				4,08
1,3		1,46	0,69		4,6				4,48
1,4		1,72	0,8		4,8				4,91
1,5		2,00	0,92		5				5,36
1,6			1,05		5,2				5,83
1,7			1,19		5,4				6,33
1,8			1,34		5,6				6,86
1,9			1,5		5,8				7,42
2			1,67		6				8
2,2			2,04						

D = diametro della sfera



Durezza del campione di durezza calibrato H_C			Ripetibilità consentita del durometro (r_{rel}) %	errore ammissibile E_{rel} del durometro $\pm$ %
Indice area forza 30				
< 250 HBW			3	$\pm 3,0$
$250 \text{ HBW} \leq H_C \leq 450 \text{ HBW}$			2,5	$\pm 2,5$
> 450 HBW			2	$\pm 2,0$
Indice area forza 10	Indice area forza 5	Indice area forza 2,5		
< 100 HBW	< 70 HBW	< 70 HBW	3	$\pm 3,0$
$100 \text{ HBW} \leq H_C \leq 200 \text{ HBW}$	$70 \text{ HBW} \leq H_C \leq 100 \text{ HBW}$	N/A	3	$\pm 3,0$
> 200 HBW	> 100 HBW	N/A	3	$\pm 3,0$

Durezza del campione di durezza calibrato H_{CRM}	Ripetibilità HV relativa massima ammissibile del durometro r_{rel} %HV		
	da HV 5 a HV 100	da HV 0,2 a < HV 5	< HV 0,2
HV ≤ 250	6,0%	12,0%	18,0%
HV > 250	4,0%	8,0%	12,0%

Lunghezza diagonale media $\bar{d}$ mm	Errore massimo consentito HV b_{rel} del durometro ± % HV
$0,02 \leq \bar{d} < 0,06$	$0,24/\leq \bar{d}$
$0,06 \leq \bar{d} \leq 1,4$	3

$$\bar{d} = \frac{(d_1 + d_2 + d_3 + d_4 + d_5)}{5}$$

Scala Rockwell	Intervallo di durezza del campione di durezza calibrato	Inclinazione consentita unità Rockwell	Intervallo di ripetibilità consentito del durometro*
HRA	45-75	± 2 HRA	≤ 0,02 (100 - H) o 0,8 HRA ¹
HRBW	80-95	± 1,5 HRA	
	Ok1 50	± 4 HRBW	
	60-80	± 3 HRBW	≤ 0,04 (130 - H) HRBW
	85-100	± 2 HRBW	
HRC	Ok1 30		
	35-55	± 1,5 HRC	≤ 0,02 (100 - H) o 0,8 HRC ¹
	60-70		
	40-47	± 2 HRD	≤ 0,02 (100 - H) o 0,8 HRD ¹
HRD	55-63	± 1,5 HRD	
	70-77		
	84-90	± 2,5 HREW	≤ 0,04 (130 - H) HREW
	93-100	± 2 HREW	
HRFW	60-75	± 3 HRFW	≤ 0,04 (130 - H) HRFW
	80-90		
	94-100	± 2 HRFW	
	30-50	± 6 HRGW	
HRGW	55-75	± 4,5 HRGW	≤ 0,04 (130 - H) HRGW
	80-94	± 3 HRGW	
	80-94	± 2 HRHW	≤ 0,04 (130 - H) HRHW
	96-100	± 4 HRKW	
HRHW	40-60	± 3 HRKW	≤ 0,04 (130 - H) HRKW
	65-80	± 2 HRN	≤ 0,04 (100 - H) o 1,2 HRN ¹
	85-100	± 3 HRTW	≤ 0,06 (100 - H) o 2,4 HRTW ¹

* Il valore più alto fra i due è considerato l'intervallo di ripetibilità consentito del durometro.

DIAMETRI DELLE INDENTAZIONI DI LUNGHEZZE DELLE DIAGONALI

Pacchetto
formazione

Mitutoyo

Diametro medio Brinell ISO 6506 $d = \frac{d_1 + d_2}{2}$

Indice area forza 30	HBW 10/3000	HBW 5/750	HBW 2,5/187,5	HBW 1/30	Indice area forza 10	HBW 10/1000	HBW 5/250	HBW 2,5/62,5	HBW 1/10	Indice area forza 5	HBW 10/500	HBW 5/125	HBW 2,5/31,25	HBW 1/5	Indice area forza 2,5	HBW 10/250	HBW 5/62,5	HBW 2,5/15,625	HBW 1/2,5
30	d/mm	d/mm	d/mm	d/mm	10	d/mm	d/mm	d/mm	d/mm	5	d/mm	d/mm	d/mm	d/mm	2,5	d/mm	d/mm	d/mm	d/mm
95,57	6,00	3,000	1,500	0,600	31,84	6,00	3,000	1,500	0,600	15,92	6,00	3,000	1,500	0,600	7,96	6,00	3,000	1,500	0,600
96,60	5,91	2,965	1,482	0,587	32,20	5,91	2,965	1,482	0,587	16,10	5,91	2,965	1,482	0,587	8,09	5,91	2,965	1,482	0,587
97,70	5,84	2,920	1,460	0,584	32,57	5,84	2,920	1,460	0,584	16,28	5,84	2,920	1,460	0,584	8,14	5,84	2,920	1,460	0,584
98,82	5,81	2,955	1,4775	0,591	32,94	5,81	2,955	1,4775	0,591	16,47	5,81	2,955	1,4775	0,591	8,24	5,81	2,955	1,4775	0,591
99,95	5,88	2,940	1,4700	0,588	33,32	5,88	2,940	1,4700	0,588	16,66	5,88	2,940	1,4700	0,588	8,33	5,88	2,940	1,4700	0,588
101,10	5,85	2,925	1,4625	0,585	33,70	5,85	2,925	1,4625	0,585	16,85	5,85	2,925	1,4625	0,585	8,43	5,85	2,925	1,4625	0,585
102,28	5,82	2,910	1,4550	0,582	34,09	5,82	2,910	1,4550	0,582	17,04	5,82	2,910	1,4550	0,582	8,52	5,82	2,910	1,4550	0,582
103,45	5,79	2,895	1,4475	0,579	34,48	5,79	2,895	1,4475	0,579	17,24	5,79	2,895	1,4475	0,579	8,62	5,79	2,895	1,4475	0,579
104,65	5,76	2,880	1,4400	0,576	34,88	5,76	2,880	1,4400	0,576	17,44	5,76	2,880	1,4400	0,576	8,72	5,76	2,880	1,4400	0,576
105,87	5,73	2,865	1,4325	0,573	35,29	5,73	2,865	1,4325	0,573	17,64	5,73	2,865	1,4325	0,573	8,82	5,73	2,865	1,4325	0,573
107,11	5,70	2,850	1,4250	0,570	35,71	5,70	2,850	1,4250	0,570	17,85	5,70	2,850	1,4250	0,570	8,93	5,70	2,850	1,4250	0,570
108,37	5,67	2,835	1,4175	0,567	36,13	5,67	2,835	1,4175	0,567	18,06	5,67	2,835	1,4175	0,567	9,03	5,67	2,835	1,4175	0,567
109,65	5,64	2,820	1,4100	0,564	36,56	5,64	2,820	1,4100	0,564	18,27	5,64	2,820	1,4100	0,564	9,14	5,64	2,820	1,4100	0,564
110,95	5,61	2,805	1,4025	0,561	36,98	5,61	2,805	1,4025	0,561	18,49	5,61	2,805	1,4025	0,561	9,25	5,61	2,805	1,4025	0,561
112,27	5,58	2,790	1,3950	0,558	37,42	5,58	2,790	1,3950	0,558	18,71	5,58	2,790	1,3950	0,558	9,36	5,58	2,790	1,3950	0,558
113,61	5,55	2,775	1,3875	0,555	37,87	5,55	2,775	1,3875	0,555	18,93	5,55	2,775	1,3875	0,555	9,47	5,55	2,775	1,3875	0,555
114,98	5,52	2,760	1,3800	0,552	38,33	5,52	2,760	1,3800	0,552	19,16	5,52	2,760	1,3800	0,552	9,58	5,52	2,760	1,3800	0,552
116,36	5,49	2,745	1,3725	0,549	38,79	5,49	2,745	1,3725	0,549	19,39	5,49	2,745	1,3725	0,549	9,70	5,49	2,745	1,3725	0,549
117,77	5,46	2,730	1,3650	0,546	39,26	5,46	2,730	1,3650	0,546	19,63	5,46	2,730	1,3650	0,546	9,82	5,46	2,730	1,3650	0,546
119,20	5,43	2,715	1,3575	0,543	39,73	5,43	2,715	1,3575	0,543	19,87	5,43	2,715	1,3575	0,543	9,93	5,43	2,715	1,3575	0,543
120,66	5,40	2,700	1,3500	0,540	40,22	5,40	2,700	1,3500	0,540	20,11	5,40	2,700	1,3500	0,540	10,06	5,40	2,700	1,3500	0,540
122,13	5,37	2,685	1,3425	0,537	40,71	5,37	2,685	1,3425	0,537	20,35	5,37	2,685	1,3425	0,537	10,18	5,37	2,685	1,3425	0,537
123,64	5,34	2,670	1,3350	0,534	41,21	5,34	2,670	1,3350	0,534	20,60	5,34	2,670	1,3350	0,534	10,30	5,34	2,670	1,3350	0,534
125,17	5,31	2,655	1,3275	0,531	41,72	5,31	2,655	1,3275	0,531	20,86	5,31	2,655	1,3275	0,531	10,43	5,31	2,655	1,3275	0,531
126,72	5,28	2,640	1,3200	0,528	42,24	5,28	2,640	1,3200	0,528	21,13	5,28	2,640	1,3200	0,528	10,56	5,28	2,640	1,3200	0,528
128,30	5,25	2,625	1,3125	0,525	42,77	5,25	2,625	1,3125	0,525	21,38	5,25	2,625	1,3125	0,525	10,69	5,25	2,625	1,3125	0,525
129,91	5,22	2,610	1,3050	0,522	43,31	5,22	2,610	1,3050	0,522	21,65	5,22	2,610	1,3050	0,522	10,83	5,22	2,610	1,3050	0,522
131,55	5,19	2,595	1,2975	0,519	43,85	5,19	2,595	1,2975	0,519	21,92	5,19	2,595	1,2975	0,519	10,96	5,19	2,595	1,2975	0,519
133,21	5,16	2,580	1,2900	0,516	44,41	5,16	2,580	1,2900	0,516	22,20	5,16	2,580	1,2900	0,516	11,10	5,16	2,580	1,2900	0,516
134,90	5,13	2,565	1,2825	0,513	44,97	5,13	2,565	1,2825	0,513	22,48	5,13	2,565	1,2825	0,513	11,24	5,13	2,565	1,2825	0,513
136,61	5,10	2,550	1,2750	0,510	45,54	5,10	2,550	1,2750	0,510	22,77	5,10	2,550	1,2750	0,510	11,38	5,10	2,550	1,2750	0,510
138,38	5,07	2,535	1,2675	0,507	46,13	5,07	2,535	1,2675	0,507	23,06	5,07	2,535	1,2675	0,507	11,53	5,07	2,535	1,2675	0,507
140,16	5,04	2,520	1,2600	0,504	46,72	5,04	2,520	1,2600	0,504	23,36	5,04	2,520	1,2600	0,504	11,68	5,04	2,520	1,2600	0,504
141,98	5,01	2,505	1,2525	0,501	47,33	5,01	2,505	1,2525	0,501	23,66	5,01	2,505	1,2525	0,501	11,83	5,01	2,505	1,2525	0,501
143,83	4,98	2,490	1,2450	0,498	47,94	4,98	2,490	1,2450	0,498	23,97	4,98	2,490	1,2450	0,498	11,99	4,98	2,490	1,2450	0,498
145,71	4,95	2,475	1,2375	0,495	48,57	4,95	2,475	1,2375	0,495	24,28	4,95	2,475	1,2375	0,495	12,14	4,95	2,475	1,2375	0,495
147,62	4,92	2,460	1,2300	0,492	49,21	4,92	2,460	1,2300	0,492	24,60	4,92	2,460	1,2300	0,492	12,30	4,92	2,460	1,2300	0,492
149,58	4,89	2,445	1,2225	0,489	49,86	4,89	2,445	1,2225	0,489	24,93	4,89	2,445	1,2225	0,489	12,47	4,89	2,445	1,2225	0,489
151,57	4,86	2,430	1,2150	0,486	50,52	4,86	2,430	1,2150	0,486	25,26	4,86	2,430	1,2150	0,486	12,63	4,86	2,430	1,2150	0,486
153,59	4,83	2,415	1,2075	0,483	51,19	4,83	2,415	1,2075	0,483	25,60	4,83	2,415	1,2075	0,483	12,80	4,83	2,415	1,2075	0,483
155,66	4,80	2,400	1,2000	0,480	51,89	4,80	2,400	1,2000	0,480	25,94	4,80	2,400	1,2000	0,480	12,97	4,80	2,400	1,2000	0,480
157,77	4,77	2,385	1,1925	0,477	52,60	4,77	2,385	1,1925	0,477	26,29	4,77	2,385	1,1925	0,477	13,16	4,77	2,385	1,1925	0,477
159,90	4,74	2,370	1,1850	0,474	53,30	4,74	2,370	1,1850	0,474	26,65	4,74	2,370	1,1850	0,474	13,33	4,74	2,370	1,1850	0,474
162,08	4,71	2,355	1,1775	0,471	54,03	4,71	2,355	1,1775	0,471	27,01	4,71	2,355	1,1775	0,471	13,51	4,71	2,355	1,1775	0,471
164,30	4,68	2,340	1,1700	0,468	54,77	4,68	2,340	1,1700	0,468	27,38	4,68	2,340	1,1700	0,468	13,69	4,68	2,340	1,1700	0,468
166,57	4,65	2,325	1,1625	0,465	55,53	4,65	2,325	1,1625	0,465	27,76	4,65	2,325	1,1625	0,465	13,88	4,65	2,325	1,1625	0,465
168,88	4,62	2,310	1,1550	0,462	56,30	4,62	2,310	1,1550	0,462	28,15	4,62	2,310	1,1550	0,462	14,08	4,62	2,310	1,1550	0,462
171,24	4,59	2,295	1,1475	0,459	57,08	4,59	2,295	1,1475	0,459	28,54	4,59	2,295	1,1475	0,459	14,28	4,59	2,295	1,1475	0,459
173,64	4,56	2,280	1,1400	0,456	57,88	4,56	2,280	1,1400	0,456	28,94	4,56	2,280	1,1400	0,456	14,47	4,56	2,280	1,1400	0,456
176,09	4,53	2,265	1,1325	0,453	58,70	4,53	2,265	1,1325	0,453	29,35	4,53	2,265	1,1325	0,453	14,68	4,53	2,265	1,1325	0,453
178,59	4,50	2,250	1,1250	0,450	59,53	4,50	2,250	1,1250	0,450	29,76	4,50	2,250	1,1250	0,450	14,88	4,50	2,250	1,1250	0,450
181,14	4,47	2,235	1,1175	0,447	60,38	4,47	2,235	1,1175	0,447	30,19	4,47	2,235	1,1175	0,447	15,10	4,47	2,235	1,1175	0,447
183,74	4,44	2,220	1,1100	0,444	61,25	4,44	2,220	1,1100	0,444	30,62	4,44	2,220	1,1100	0,444	15,31	4,44	2,220	1,1100	0,444
186,39	4,41	2,205	1,1025	0,441	62,13	4,41	2,205	1,1025	0,441	31,06	4,41	2,205	1,1025	0,441	15,53	4,41	2,205	1,1025	0,441
189,10	4,38	2,190	1,0950	0,438	63,04	4,38	2,190	1,0950	0,438	31,51	4,38	2,190	1,0950	0,438	15,76	4,38	2,190	1,0950	0,438
191,87	4,35	2,175	1,0875	0,435	63,96	4,35	2,175	1,0875	0,435	31,98	4,35	2,175	1,0875	0,435	15,99	4,35	2,175	1,0875	0,435
194,69	4,32	2,160	1,0800	0,432	64,90	4,32	2,160	1,0800	0,432	32,45	4,32	2,160	1,0800	0,432	16,23	4,32	2,160	1,0800	0,432
197,57	4,29	2,145	1,0725	0,429	65,86	4,29	2,145	1,											

TABELLE DI CONVERSIONE DELLE DUREZZE

Mitutoyo

Pacchetto
formazione

Acciai non legati e debolmente legati e acciaio fuso

Resistenza a trazione	Vickers durezza	Brinell durezza	Durezza Rockwell								
MPa	HV10	HBS	HBW	HRB	HRF	HRC	HRA	HRD	HR15N	HR30N	HR45N
255,0	80,0	76,0									
270,0	85,0	80,7		41,0							
285,0	90,0	85,5		48,0	82,6						
305,0	95,0	90,2		52,0							
320,0	100,0	95,0		56,2	87,0						
335,0	105,0	99,8									
350,0	110,0	105,0		62,3	90,5						
370,0	115,0	109,0									
385,0	120,0	114,0		66,7	93,6						
400,0	125,0	119,0									
415,0	130,0	124,0		71,2	96,4						
430,0	135,0	128,0									
450,0	140,0	133,0		75,0	99,0						
465,0	145,0	138,0									
480,0	150,0	143,0		78,7	101,4						
495,0	155,0	147,0									
510,0	160,0	152,0		81,7	103,6						
530,0	165,0	156,0									
545,0	170,0	162,0		85,0	105,5						
560,0	175,0	166,0									
575,0	180,0	171,0		87,1	107,2						
595,0	185,0	176,0									
610,0	190,0	181,0		89,5	108,7						
625,0	195,0	185,0									
640,0	200,0	190,0		91,5	110,1						
660,0	205,0	195,0		92,5							
675,0	210,0	199,0		93,5	111,3						
690,0	215,0	204,0		94,0							
705,0	220,0	209,0		95,0	112,4						
720,0	225,0	214,0		96,0							
740,0	230,0	219,0		96,7	113,4						
755,0	235,0	223,0									
770,0	240,0	228,0		98,1	114,3	20,3	60,7	40,3	69,6	41,7	19,9
785,0	245,0	233,0				21,3	61,2	41,1	70,1	42,5	21,1
800,0	250,0	238,0		99,5	115,1	22,2	61,6	41,7	70,6	43,4	22,2
820,0	255,0	242,0				23,1	62,0	42,2	71,1	44,2	23,2
835,0	260,0	247,0				24,0	62,4	43,1	71,6	45,0	24,3
850,0	265,0	252,0				24,8	62,7	43,7	72,1	45,7	25,2
865,0	270,0	257,0				25,6	63,1	44,3	72,6	46,4	26,2
880,0	275,0	261,0				26,4	63,5	44,9	73,0	47,2	27,1
900,0	280,0	266,0				27,1	63,8	45,3	73,4	47,8	27,9
915,0	285,0	271,0				27,8	64,2	46,0	73,8	48,4	28,7
930,0	290,0	276,0				28,5	64,5	46,5	74,2	49,0	29,5
950,0	295,0	280,0				29,2	64,8	47,1	74,6	49,7	30,4
965,0	300,0	285,0				29,8	65,2	47,5	74,9	50,2	31,1
995,0	310,0	295,0				31,0	65,8	48,4	75,6	51,3	32,5
1.030	320,0	304,0				32,2	66,4	49,4	76,2	52,3	33,9
1.060	330,0	314,0				33,3	67,0	50,2	76,8	53,6	35,2
1.095	340,0	323,0				34,4	67,6	51,1	77,4	54,4	36,5
1.125	350,0	333,0				35,5	68,1	51,9	78,0	55,4	37,8
1.155	360,0	342,0				36,6	68,7	52,8	78,6	56,4	39,1
1.190	370,0	352,0				37,7	69,2	53,6	79,2	57,4	40,4
1.220	380,0	361,0				38,8	69,8	54,4	79,8	58,4	41,7
1.255	390,0	371,0				39,8	70,3	55,3	80,3	59,3	42,9
1.290	400,0	380,0				40,8	70,8	56,0	80,8	60,2	44,1
1.320	410,0	390,0				41,8	71,4	56,8	81,4	61,1	45,3
1.350	420,0	399,0				42,7	71,8	57,5	81,8	61,9	46,4
1.385	430,0	409,0				43,6	72,3	58,2	82,3	62,7	47,4
1.420	440,0	418,0				44,5	72,8	58,8	82,8	63,5	48,4
1.455	450,0	428,0				45,3	73,3	59,4	83,2	64,3	49,4
1.485	460,0	437,0				46,1	73,6	60,1	83,6	64,9	50,4
1.520	470,0	447,0				46,9	74,1	60,7	83,9	65,7	51,3
1.555	480,0		456,0			47,7	74,5	61,3	84,3	66,4	52,2
1.595	490,0		466,0			48,4	74,9	61,6	84,7	67,1	53,1
1.630	500,0		475,0			49,1	75,3	62,2	85,0	67,7	53,9
1.665	510,0		485,0			49,8	75,7	62,9	85,4	68,3	54,7
1.700	520,0		494,0			50,5	76,1	63,5	85,7	69,0	55,6
1.740	530,0		504,0			51,1	76,4	63,9	86,0	69,5	56,2
1.775	540,0		513,0			51,7	76,7	64,4	86,3	70,0	57,0
1.810	550,0		523,0			52,3	77,0	64,8	86,6	70,5	57,8
1.845	560,0		532,0			53,0	77,4	65,4	86,9	71,2	58,6
1.880	570,0		542,0			53,6	77,8	65,8	87,2	71,7	59,3
1.920	580,0		551,0			54,1	78,0	66,2	87,5	72,1	59,9
1.955	590,0		561,0			54,7	78,4	66,7	87,8	72,7	60,5
1.995	600,0		570,0			55,2	78,6	67,0	88,0	73,2	61,2
2.030	610,0		580,0			55,7	78,9	67,5	88,2	73,7	61,7
2.070	620,0		589,0			56,3	79,2	67,9	88,5	74,2	62,4
2.105	630,0		599,0			56,8	79,5	68,3	88,8	74,6	63,0
2.145	640,0		608,0			57,3	79,8	68,7	89,0	75,1	63,5
2.180	650,0		618,0			57,8	80,0	69,0	89,2	75,5	64,1
	660,0					58,3	80,3	69,4	89,5	75,9	64,7
	670,0					58,8	80,6	69,8	89,7	76,4	65,3
	680,0					59,2	80,8	70,1	89,8	76,8	65,7
	690,0					59,7	81,1	70,5	90,1	77,2	66,2
	700,0					60,1	81,3	70,8	90,3	77,6	66,7
	720,0					61,0	81,8	71,5	90,7	78,4	67,7
	740,0					61,8	82,2	72,1	91,0	79,1	68,6
	760,0					62,5	82,6	72,6	91,2	79,7	69,4
	780,0					63,3	83,0	73,3	91,5	80,4	70,2
	800,0					64,0	83,4	73,8	91,8	81,1	71,0
	820,0					64,7	83,8	74,3	92,1	81,7	71,8
	840,0					65,3	84,1	74,8	92,3	82,2	72,2
	860,0					65,9	84,4	75,3	92,5	82,7	73,1
	880,0					66,4	84,7	75,7	92,7	83,1	73,6
	900,0					67,0	85,0	76,1	92,9	83,6	74,2
	920,0					67,5	85,3	76,5	93,0	84,0	74,8
	940,0					68,0	85,6	76,9	93,2	84,4	75,4

Ottone

Vickers durezza HV	Rockwell durezza		Rockwell Superficiale durezza			Brinell durezza HBS 10/500
	HRB	HRF	HR15T	HR30T	HR45T	
45,0						42,0
46,0						43,0
47,0						44,0
48,0						45,0
49,0						46,0
50,0						47,0
52,0						48,0
54,0						50,0
56,0						52,0
58,0		61,0				53,0
60,0		62,5				55,0
62,0		65,0				57,0
64,0		66,8				59,0
66,0	18,5	68,5				61,0
68,0	21,5	70,0	67,0	30,0		62,0
70,0	24,5	71,8	68,0	32,0		63,0
72,0	27,5	73,2	69,0	34,0		64,0
74,0	30,0	74,8	70,0	36,0		66,0
76,0	32,5	76,0	70,5	38,0		68,0
78,0	35,0	77,4	71,5	39,5		70,0
80,0	37,5	78,6	72,0	41,0	10,0	72,0
82,0	40,0	80,0	73,0	43,0	12,5	74,0
84,0	42,0	81,2	73,5	44,0	14,5	76,0
86,0	44,0	82,3	74,5	45,5	17,0	77,0
88,0	46,0	83,5	75,0	47,0	19,0	79,0
90,0	47,5	84,4	75,5	48,0	21,0	80,0
92,0	49,5	85,4	76,5	49,0	23,0	82,0
94,0	51,0	86,3	77,0	50,5	24,5	83,0
96,0	53,0	87,2	77,5	51,5	26,5	85,0
98,0	54,0	88,0	78,0	52,5	28,0	86,0
100,0	56,0	89,0	78,5	53,5	29,5	88,0
102,0	57,0	89,8	79,0	54,5	30,5	90,0
104,0	58,0	90,5	79,5	55,0	32,0	92,0
106,0	59,5	91,2	80,0	56,0	33,0	94,0
108,0	61,0	92,0		57,0	34,5	95,0
110,0	62,0	92,6	80,5	58,0	35,5	97,0
112,0	63,0	93,0	81,0	58,5	37,0	99,0
114,0	64,0	94,0	81,5	59,5	38,0	101,0
116,0	65,0	94,5	82,0	60,0	39,0	103,0
118,0	66,0	95,0	82,5	60,5	40,0	105,0
120,0	67,0	95,5		61,0	41,0	106,0
122,0	68,0	96,0	83,0	62,0	42,0	108,0
124,0	69,0	96,5		62,5	43,0	110,0
126,0	70,0	97,0	83,5	63,0	44,0	112,0
128,0	71,0	97,5		63,5	45,0	113,0
130,0	72,0	98,0	84,0	64,5	45,5	114,0
132,0	73,0	98,5	84,5	65,0	46,5	116,0
134,0	73,5	99,0		65,5	47,5	118,0
136,0	74,5	99,5	85,0	66,0	48,0	120,0
138,0	75,0	100,0		66,5	49,0	121,0
140,0	76,0	100,5	85,5	67,0	50,0	122,0
142,0	77,0	101,0		67,5	51,0	124,0
144,0	77,5	101,5	86,0	68,0	51,5	126,0
146,0	78,0	102,0		68,5	52,5	128,0
148,0	79,0	102,5		69,0	53,0	129,0
150,0	80,0		86,5	69,5	53,5	131,0
152,0	80,5	103,0			54,0	133,0
154,0	81,5	103,5		70,0	54,5	135,0
156,0	82,0	104,0	87,0	70,5	55,5	136,0
158,0	83,0	104,5		71,0	56,0	138,0
160,0	83,5			71,5	56,5	139,0
162,0	84,0	105,0	87,5		57,5	141,0
164,0	85,0	105,5		72,0	58,0	142,0
166,0	85,5			72,5	58,5	144,0
168,0	86,0	106,0	88,0	73,0	59,0	146,0
170,0	87,0				59,5	147,0
172,0	87,5	106,5		73,5	60,0	149,0
174,0	88,0		88,5	74,0	60,5	150,0
176,0	88,5	107,0			61,0	152,0
178,0	89,0			74,5	61,5	154,0
180,0	90,0	107,5		75,0	62,0	156,0
182,0	90,5	108,0	89,0		62,5	157,0
184,0	91,0			75,5	63,0	159,0
186,0	91,5	108,5		76,0	63,5	161,0
188,0	92,0		89,5		64,0	162,0
190,0	92,5	109,0		76,5	64,5	164,0
192,0	93,0			77,0	65,0	166,0
194,0		109,5			65,5	167,0
196,0	93,5	110,0	90,0	77,5	66,0	169,0