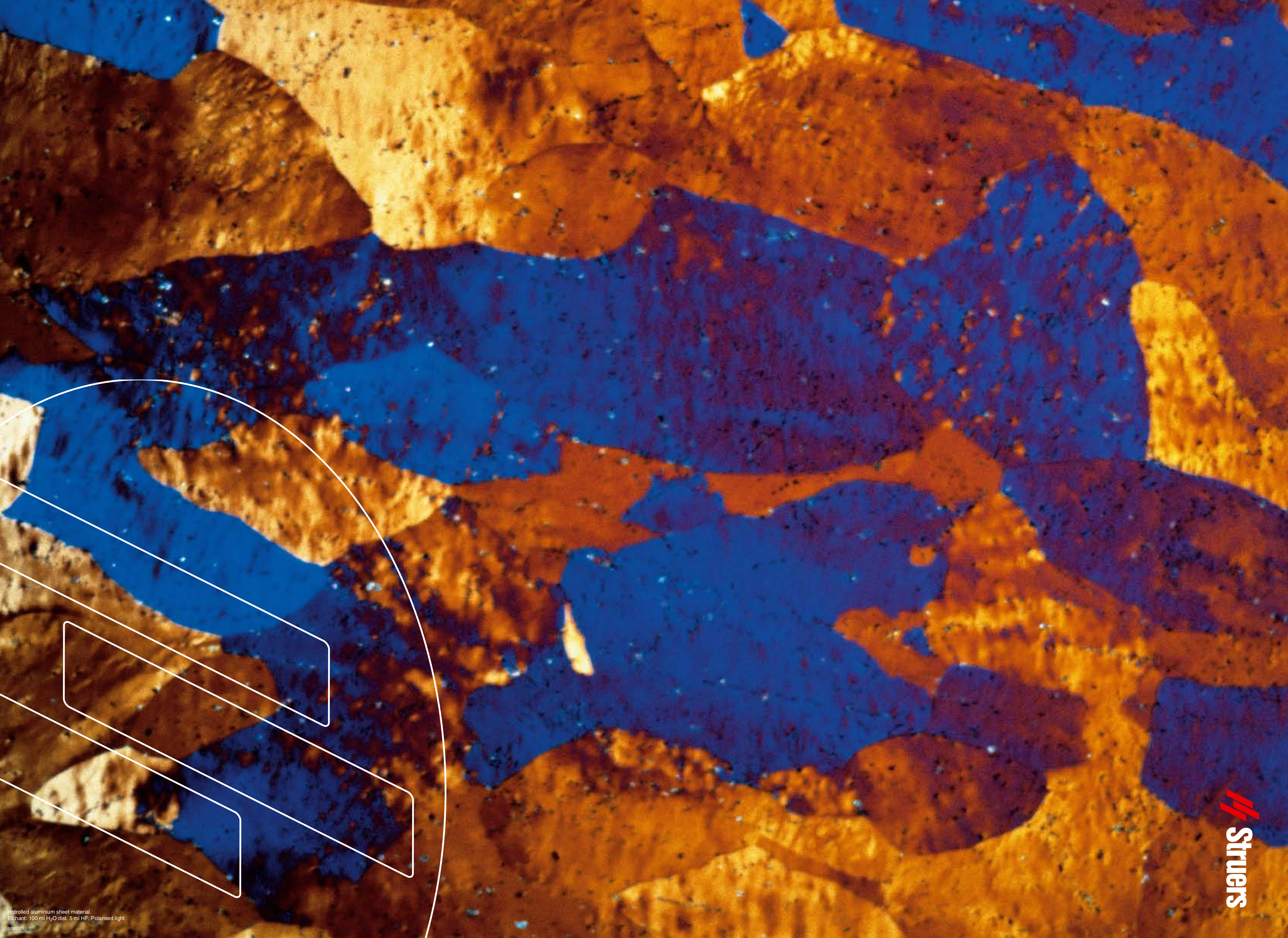
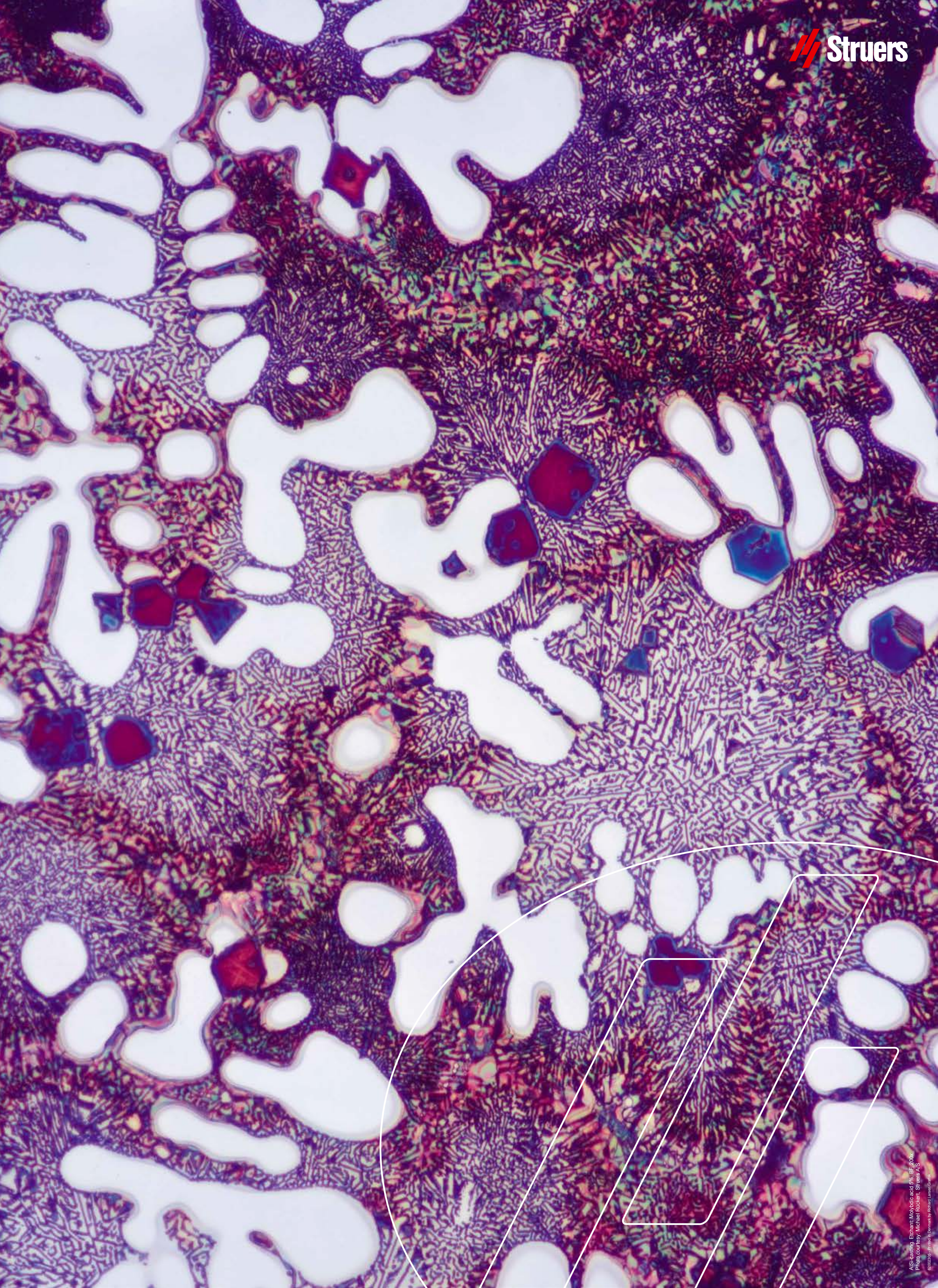


Hotrolled aluminium sheet material.
Etchant: 100 ml H_2O dist. 5 ml HF. Polarised light

62002103

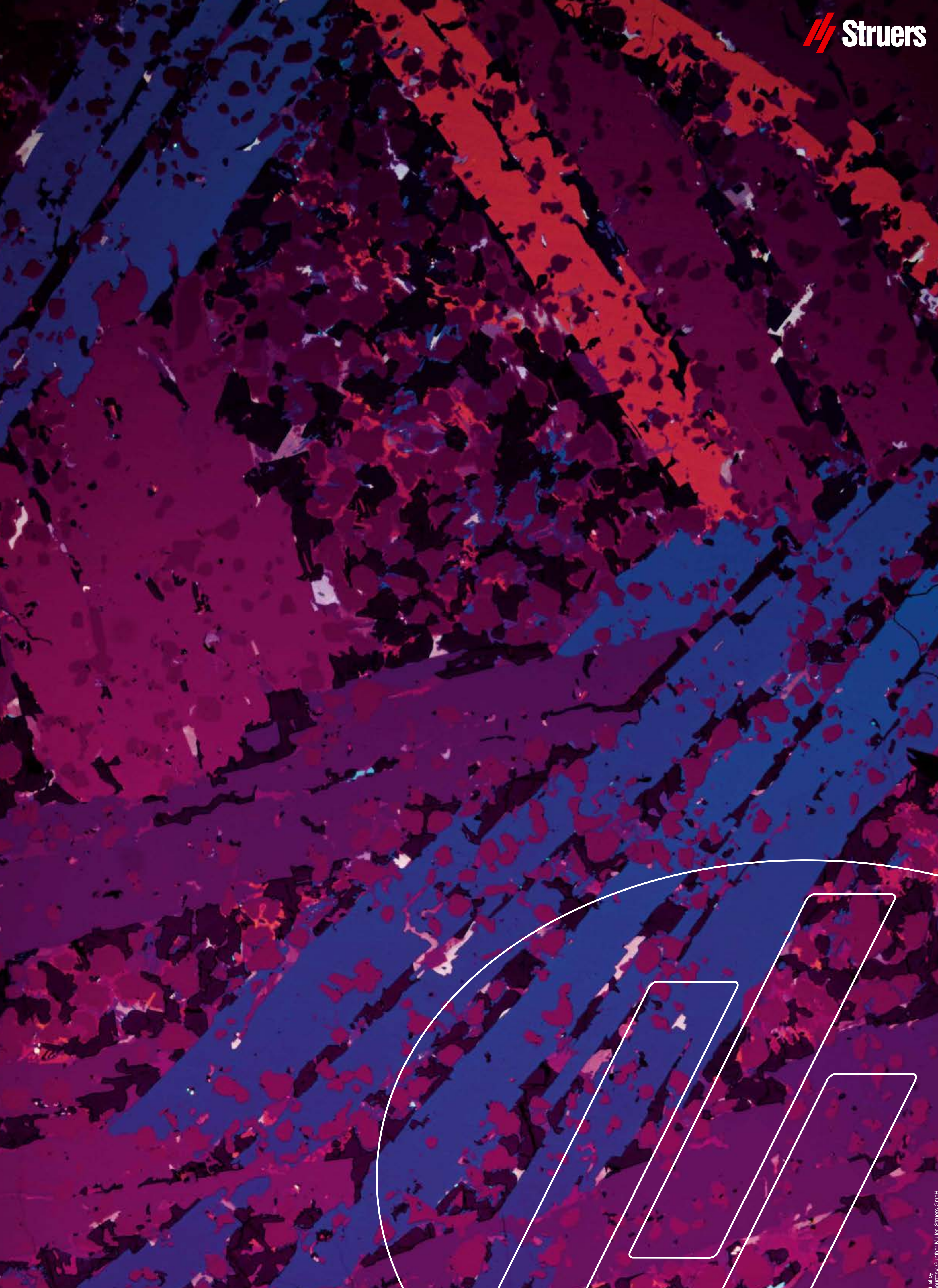
Overheated zone in a steel weld.
Etchant: according to Klemm I. Polarised light

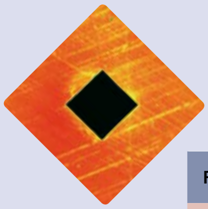
62002203



AlSi-casting. Etchant: Molybdic acid 5%, BF, 200x
Photo courtesy: Michael Rückert, Struers A/S

62002305 - Printed in Denmark by Richard Larsen Grafisk


i alloy
ourtesy: Günther Müller, Struers GmbH



Hardness Conversion Table
for Non-Austenitic Steels

www.struers.com

Rockwell C	Vickers	Brinell		Knoop	Rockwell		Rockwell Superficial			Scleroscope
		10 mm Steel ball	10 mm Carbide ball		A Scale	D Scale	15N Scale	30N Scale	45N Scale	
150 kgf		3000 kgf	3000 kgf	500 gf and over	60 kgf	100 kgf	15 kgf	30 kgf	45 kgf	
(HRC)	(HV)	(HBS30)	(HBW30)	(HK)	(HRA)	(HRD)	(HR15N)	(HR30N)	(HR45N)	
68	940	...	...	920	85.6	76.9	93.2	84.4	75.4	97.3
67	900	...	...	895	85.0	76.1	92.9	83.6	74.2	95.0
66	865	...	...	870	84.5	75.4	92.5	82.8	43.3	92.7
65	832	...	(739)	846	83.9	74.5	92.2	81.9	72.0	90.6
64	800	...	(722)	822	83.4	73.8	91.8	81.1	71.0	88.5
63	772	...	(705)	799	82.8	73.0	91.4	80.1	69.9	865
62	746	...	(688)	776	82.3	72.2	91.1	79.3	68.8	84.5
61	720	...	(670)	754	81.8	71.5	90.7	78.4	67.7	82.6
60	697	...	(654)	732	81.2	70.7	90.2	77.5	66.6	80.8
59	674	...	634	710	80.7	69.9	89.8	76.6	65.5	79.0
58	653	...	615	690	80.1	69.2	89.3	75.7	64.3	77.3
57	633	...	595	670	79.6	68.5	88.9	74.8	63.2	75.6
56	613	...	577	650	79.0	67.7	88.3	73.9	62.0	74.0
55	595	...	560	630	78.5	66.9	87.9	73.0	60.9	72.4
54	577	...	543	612	78.0	66.1	87.4	72.0	59.8	70.9
53	560	...	525	594	77.4	65.4	86.9	71.2	58.6	69.4
52	544	(500)	512	576	76.8	64.6	86.4	70.2	87.4	67.9
51	528	(487)	496	558	76.3	63.8	85.9	69.4	56.1	66.5
50	513	(475)	481	542	75.9	63.1	85.5	68.5	55.0	65.1
49	498	(464)	469	526	75.2	62.1	85.0	67.6	53.8	63.7
48	484	451	432	510	74.7	61.4	84.5	66.7	52.5	62.4
47	471	442	443	495	74.1	60.8	83.9	65.8	51.4	61.1
46	458	432	432	480	73.6	60.0	83.5	64.8	50.3	59.8
45	446	421	421	466	73.1	59.2	83.0	64.0	49.0	58.5
44	434	409	409	452	72.5	58.5	82.5	63.1	47.8	57.3
43	423	400	400	438	72.0	57.7	82.0	62.2	56.7	56.1
42	412	390	390	426	71.5	56.9	81.5	61.3	45.5	54.9
41	402	381	381	414	70.9	56.2	80.9	60.4	44.3	53.7
40	392	371	371	402	70.4	55.4	80.4	59.5	43.1	52.6
39	382	362	362	391	69.9	54.6	79.9	58.6	41.9	51.5
38	372	353	353	380	69.4	53.8	79.4	57.7	40.8	50.4
37	363	344	344	370	58.9	53.1	78.8	56.8	39.6	49.3
36	354	336	336	360	68.4	52.3	78.3	55.9	38.4	48.2
35	345	327	327	351	67.9	51.5	77.7	55.0	37.2	47.1
34	336	319	319	342	67.4	50.8	77.2	54.2	36.1	46.1
33	327	311	311	334	66.8	50.0	76.6	53.3	34.9	45.1
32	318	301	301	326	66.3	49.2	76.1	52.1	33.7	44.1
31	310	294	294	318	65.8	48.4	75.6	51.3	32.5	43.1
30	302	286	286	311	65.3	47.7	75.0	50.4	31.3	42.2
29	294	279	279	304	64.8	47.0	74.5	49.5	30.1	41.3
28	286	271	271	297	64.3	46.1	73.9	48.6	28.9	40.4
27	279	264	264	290	63.8	45.2	73.3	47.7	27.8	39.5
26	272	258	258	284	63.3	44.6	72.8	46.8	26.7	38.7
25	266	253	253	278	62.8	43.8	72.2	45.9	25.5	37.8
24	260	247	247	272	62.4	43.1	71.6	45.0	24.6	37.0
23	254	243	243	266	62.0	42.1	71.0	44.0	23.1	36.3
22	248	237	237	261	61.5	41.6	70.5	43.2	22.0	35.5
21	243	231	231	256	61.0	40.9	69.9	42.3	20.7	34.8
20	238	226	226	251	60.5	40.1	69.4	41.5	19.6	34.2







For further info please visit www.struers.com/hardnesstesters

62142105 / 2013 / Printed in Denmark

Iron-Carbon Equilibrium Diagram

Steel Part

Struers
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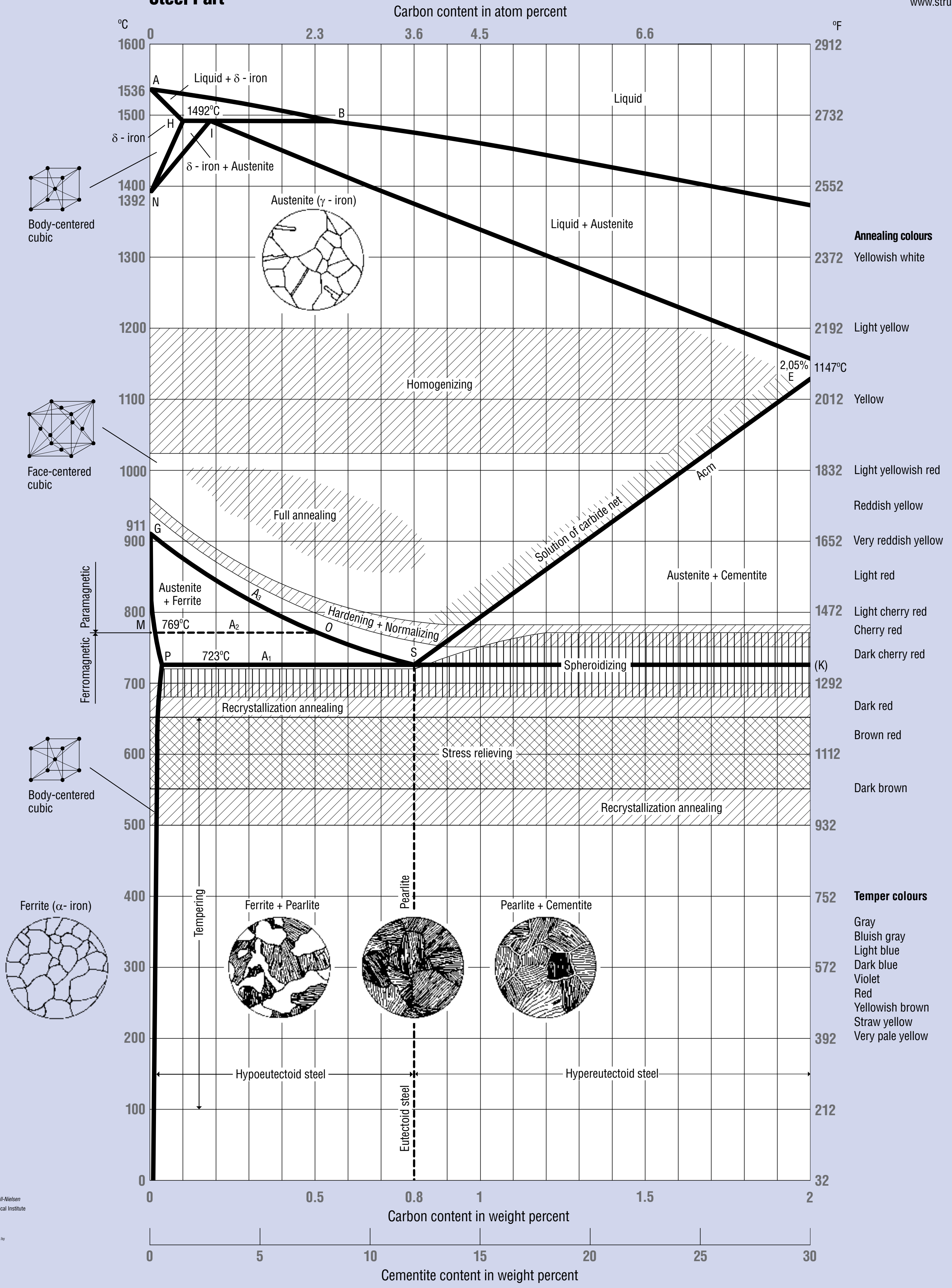
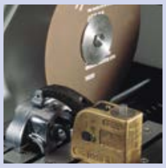


Compiled by S. Engell-Nielsen
Met. Eng. Technological Institute
Copenhagen

62142104 / Printed in Denmark by
Rosendahls Bogtrykkeri A/S









Influence of the preparation process on EBSP images on Duplex steel

Struers
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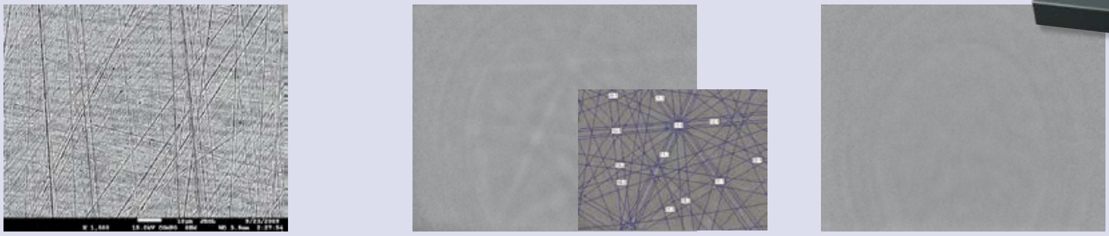
Mechanical polishing

BSE image at 0° tilt | EBSP of iron BCC phase | EBSP of iron FCC phase

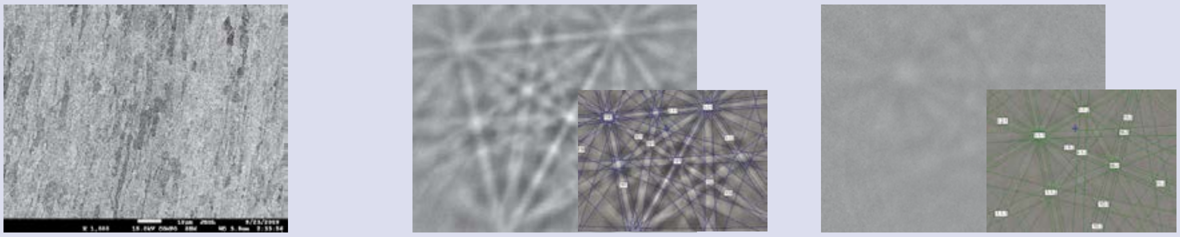
SiC-paper
800 grit
2 min

Automatic grinding and polishing equipment, TegraSystem-300

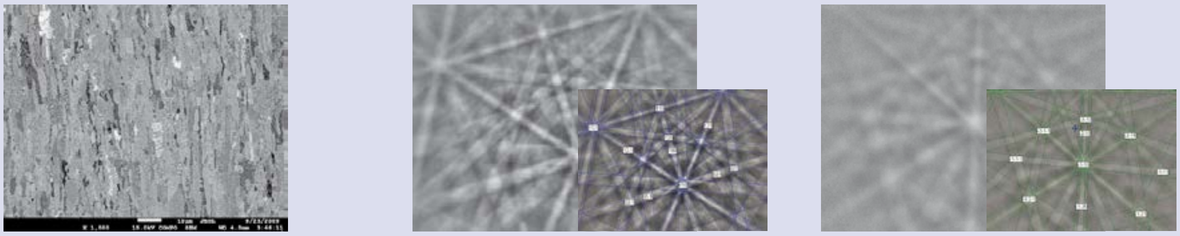
Fine grinding
9 µm
20 N
5 min



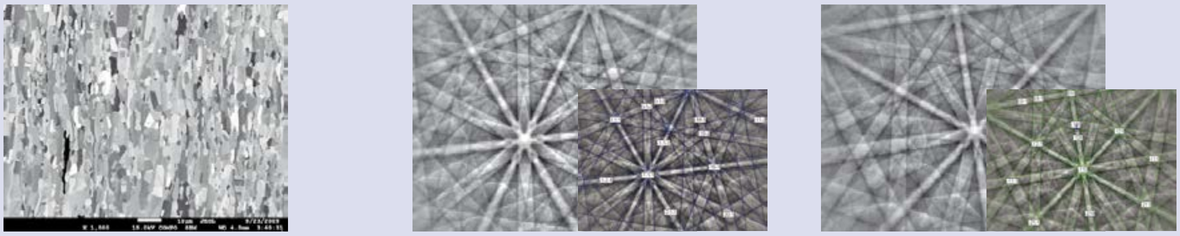
Diamond
polishing
3 µm
20 N
7 min



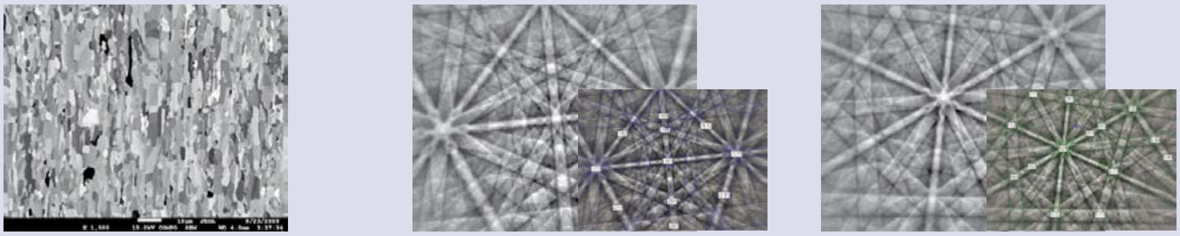
Diamond
polishing
1 µm
15 N
7 min



Oxide
polishing
15 N
30 min



Vibratory
polishing
2 hours



Mechanical grinding and electrolytical polishing

BSE image at 0° tilt | EBSP of iron BCC phase | EBSP of iron FCC phase

Automatic electrolytic equipment, LectroPol-5

SiC-paper
800 grit
1 min

Electrolytic
polishing
30 sec

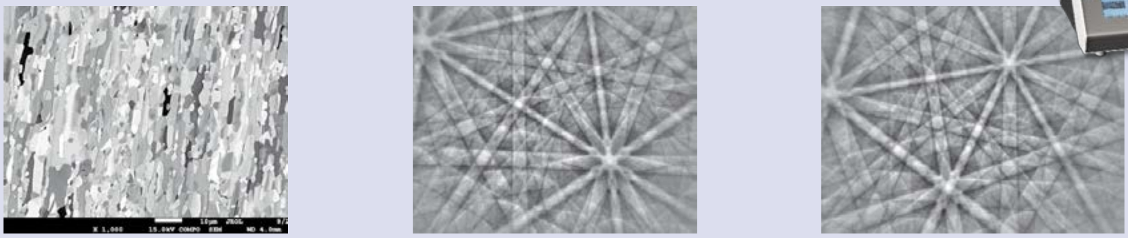


Image courtesy:
Oxford Instruments plc.

Hardness testing on metallic materials

Struers
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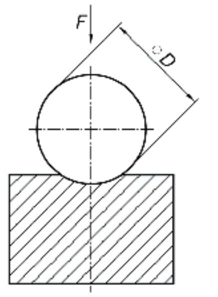
BRINELL EN ISO 6506

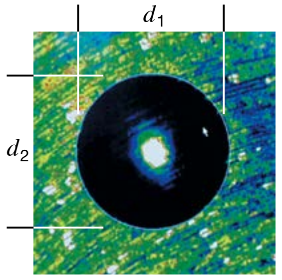
Brinell hardness HB

$$HB = \text{Constant} \cdot \frac{\text{Test-load } F}{\text{Surface of the impression}}$$

$$= 0{,}102 \cdot \frac{2F}{\pi D\,(D - \sqrt{D^2 - d^2})}$$

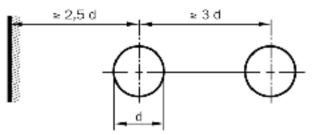
$$d = \frac{d_1 + d_2}{2} \quad \text{(mean impression-Ø)}$$





Impression- and edge distance

In order that the results will not be affected, the following distances have to be kept:



Material	Hardness-abbreviation	Penetrator carbide ball	Load	Load factor 0,102 x F / D^2	Hardness range HBW
Steel/iron	HBW 1/30 HBW 2,5/187,5 HBW 5/750 HBW 10/3000	1 mm 2,5 mm 5 mm 10 mm	30 kp 187,5 kp 750 kp 3000 kp	**30**	95–650
Light metal copper / aluminium aluminium alloy copper alloy	HBW 1/10 HBW 2,5/62,5 HBW 5/250 HBW 10/1000	1 mm 2,5 mm 5 mm 10 mm	10 kp 62,5 kp 250 kp 1000 kp	**10**	32–220
Light metal copper / aluminium aluminium alloy without heat treatm.	HBW 1/5 HBW 2,5/31,25 HBW 5/125 HBW 10/500	1 mm 2,5 mm 5 mm 10 mm	5 kp 31,25 kp 125 kp 500 kp	**5**	16–110
Light metal smaller 35 HBW	HBW 1/2,5 HBW 2,5/15,625 HBW 5/62,5 HBW 10/250	1 mm 2,5 mm 5 mm 10 mm	2,5 kp 15,625 kp 62,5 kp 250 kp	**2,5**	8– 55

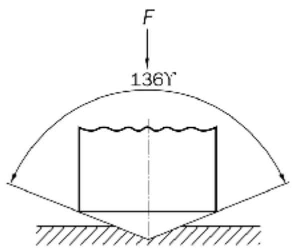
VICKERS EN ISO 6507

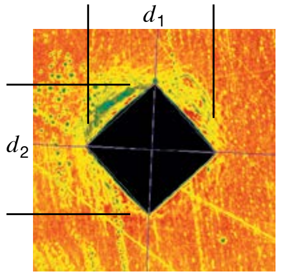
Vickers hardness HV

$$HV = \text{Constant} \times \frac{\text{Test-load } F}{\text{Surface of the impression}}$$

$$= 0{,}102\,\frac{2F \sin\frac{136°}{2}}{d^2} \approx 0{,}189\,1\,\frac{F}{d^2}$$

$$d = \frac{d_1 + d_2}{2}$$





Impression- and edge distance

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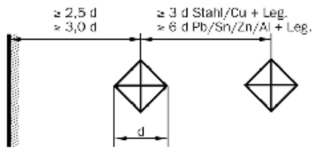
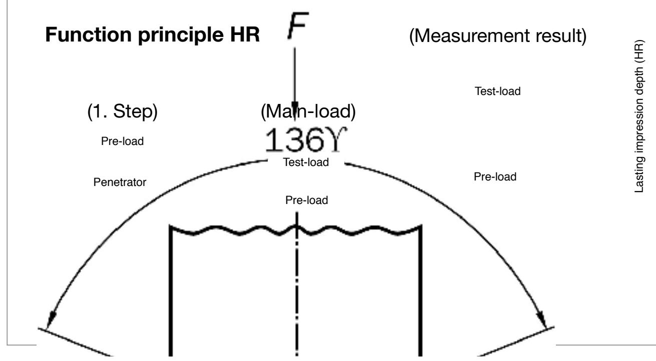


	Hardness-abbr.	Penetrator	Load	Application	
Micro hardness range	HV 0,01 HV 0,02 HV 0,05 HV 0,1 HV 0,2	Diamond pyramid 136°	0,01 kp 0,02 kp 0,05 kp 0,1 kp 0,2 kp	Structure component very thin coats	**Range 10 HV – 3000 HV**
Low load hardness range	HV 0,2 HV 0,3 HV 0,5 HV 1 HV 2 HV 3 HV 5	Diamond pyramid 136°	0,2 kp 0,3 kp 0,5 kp 1 kp 2 kp 3 kp 5 kp	Thin coats Eht-/Rht-/Nht-range thin sheets small components	
Conventional hardness range	HV 5 HV 10 HV 20 HV 30 HV 50 HV 100	Diamond pyramid 136°	5 kp 10 kp 20 kp 30 kp 50 kp 100 kp	Common components	

ROCKWELL EN ISO 6508

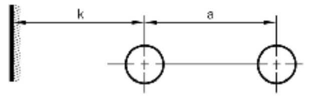
Function principle HR



	Base
HRA HRC HRD	= 100 Units (1 E = 0,002 mm)
HRB HRE HRF HRG HRH HRK	= 130 Units (1 E = 0,002 mm)
HRN HRT	= 100 Units (1 E = 0,001 mm)

Impression- and edge distance

In order that the results will not be affected, the following distances have to be kept:



Process HR	Edge distance k in mm	Impression distance a in mm
A C B F	3	3
N	1	2
T	2	2

Abbreviation for test methods	Penetrator	Pre-load F_0	Additional load F_1	Main-load F	Application range (Range of Rockwell hardness)
HRA	Diamond cone	98,07 N	490,3 N	588,6 N	20 - 88 HRA
HRB	Ball 1,587 5 mm	98,07 N	882,6 N	980,7 N	20 - 100 HRB
HRC	Diamond cone	98,07 N	1,373 kN	1,471 kN	20 - 70 HRC
HRD	Diamond cone	98,07 N	882,6 N	980,7 N	40 - 77 HRD
HRE	Ball 3,175 mm	98,07 N	882,6 N	980,7 N	70 - 100 HRE
HRF	Ball 1,587 5 mm	98,07 N	490,3 N	588,4 N	60 - 100 HRF
HRG	Ball 1,587 5 mm	98,07 N	1,373 kN	1,471 kN	30 - 94 HRG
HRH	Ball 3,175 mm	98,07 N	490,3 N	588,4 N	80 - 100 HRH
HRK	Ball 3,175 mm	98,07 N	1,373 kN	1,471 kN	40 - 100 HRK
HR15N	Diamond cone	29,42 N	117,7 N	147,1 N	70 - 94 HR15N
HR30N	Diamond cone	29,42 N	264,8 N	294,2 N	42 - 86 HR30N
HR45N	Diamond cone	29,42 N	411,9 N	441,3 N	20 - 77 HR45N
HR15T	Ball 1,587 5 mm	29,42 N	117,7 N	147,1 N	67 - 93 HR15T
HR30T	Ball 1,587 5 mm	29,42 N	264,8 N	294,2 N	29 - 82 HR30T
HR45T	Ball 1,587 5 mm	29,42 N	411,9 N	441,3 N	10 - 72 HR45T

Correction chart for Rockwell tests (HRC) on cylindrical samples

Ø of sample (mm)	6	8	10	13	15	20	25	32	40
HRC (measured)	Addition value to hardness								
20	6,0	5,0	4,5	3,5	2,5	2,0	2	1	1
25	5,5	4,5	4,0	3,0	2,5	2,0	2	1	1
30	5,0	4,0	3,5	2,5	2,0	1,5	1	1	1
35	4,0	3,5	3,0	2,0	1,5	1,5	1	1	1
40	3,5	3,0	2,5	2,0	1,5	1,0	1	1	1
45	3,0	2,5	2,0	1,5	1,0	1,0	1	1	1
50	2,5	2,0	2,0	1,5	1,0	1,0	1	1	0
55	2,0	1,5	1,5	1,0	1,0	0,5	1	1	0
60	1,5	1,0	1,0	1,0	1,0	0,5	1	0	0

Sample Ø mm		6,4	10,0	16,0	19,0	25,0	
Measurement value HR 15T HR 30T HR 45T	90	1,0	1,0	0,5	0,5	0,5	Correction value
	80	2,0	1,5	1,0	1,0	0,5	
	70	(3,5)	2,5	1,5	1,0	1,0	
	60	(4,5)	3,0	2,0	1,5	1,5	
	50	(5,5)	4,0	2,5	2,0	1,5	
	40	(6,5)	(4,5)	3,0	2,5	2,0	

Sample Ø mm		3,2	6,4	10,0	13,0	19,0	25,0	
Measurement value HR 15N HR 30N HR 45N	90	0	0	0	0	0	0	Correction value
	80	1,0	0,5	0,5	0,5	0	0	
	70	2,0	1,0	1,0	0,5	0,5	0,5	
	60	3,0	1,5	1,0	1,0	0,5	0,5	
	50	(3,5)	2,0	1,5	1,0	1,0	0,5	
	40	(4,5)	2,5	1,5	1,5	1,0	1,0	

Coherence between min. sample thickness (min. hardness coat) and Rockwell hardness

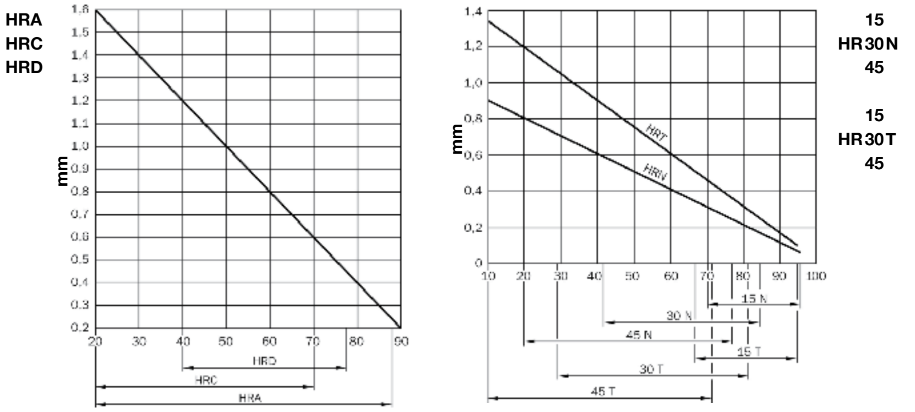
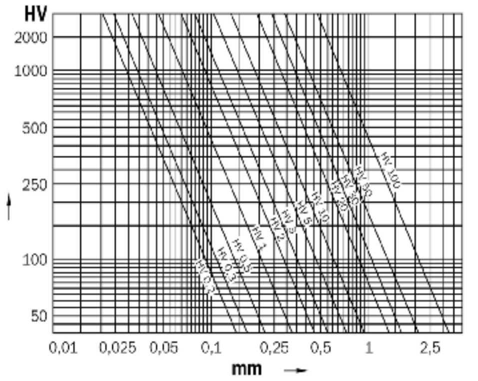


Chart for min. thickness of samples in connection to medium impression diameter with BRINELL-process

mean impression Ø d mm	Ball diameter mm 1	2,5	5	10
	Minimal thickness of sample mm			
0,2	0,08			
0,3	0,18			
0,4	0,33			
0,5	0,54			
0,6	0,80	0,29		
0,8		0,53		
1,0		0,83		
1,2		1,23	0,58	
1,4		1,72	0,80	
1,6			1,05	
1,8			1,34	
2,0			1,67	
2,2			2,04	
2,4			2,46	1,17
2,6			2,92	1,38
2,8			3,43	1,60

mean impression Ø d mm	Ball diameter mm 1	2,5	5	10
	Minimal thickness of sample mm			
3,0			4,00	1,84
3,2				2,10
3,4				2,38
3,6				2,68
3,8				3,00
4,0				3,34
4,2				3,70
4,4				4,08
4,6				4,48
4,8				4,91
5,0				5,36
5,2				5,83
5,4				6,33
5,6				6,86
5,8				7,42
6,0				8,00

Min. thickness of sample (hardness coat) in connection to load and hardness with VICKERS-process



Please note that this worksheet only shows an extract of the respective standards and does not replace a standard. Printing and setting errors excepted.

62142107 Printed in Denmark by Rosendahls

Hardness comparison chart

Struers

www.struers.com

VICKERS EN ISO 6507

HV	HV 0.05	HV 0.1	HV 0.2	HV 0.5	HV 1	HV 3	HV 5	HV 10	HV 30	HV 100
	$d = \frac{d_1 + d_2}{2}$									
	d									
	µm	µm	µm	µm	µm	µm	µm	µm	µm	mm
80	34.0	48.2	68.1	108	152	264	340	482	834	1.523
85	33.0	46.7	66.1	104	148	256	330	467	809	1.477
90	32.0	45.4	64.2	102	144	249	321	454	786	1.435
95	31.2	44.2	62.5	99	140	242	312	442	765	1.397
100	30.4	43.1	60.8	96	136	236	305	431	745	1.362
105	29.6	42.0	59.4	94	133	230	297	420	728	1.331
110	29.0	41.1	58.1	92	130	225	290	411	711	1.301
115	28.4	40.2	56.8	90	127	220	284	402	696	1.271
120	27.8	39.3	55.6	87.9	125	215	278	393	681	1.241
125	27.2	38.5	54.4	86.1	122	211	272	385	667	1.220
130	26.7	37.8	53.4	84.5	120	207	267	378	654	1.193
135	26.2	37.1	52.4	82.9	117	203	262	371	642	1.170
140	25.8	36.4	51.4	81.4	115	200	257	364	630	1.150
145	25.3	35.8	50.5	80.0	113	196	253	358	619	1.130
150	24.8	35.1	49.7	78.6	111	193	249	352	609	1.113
155	24.4	34.6	49.0	77.3	109	190	245	346	599	1.095
160	24.1	34.1	48.1	76.1	108	187	241	341	589	1.078
165	23.7	33.5	47.4	75.0	106	184	237	335	580	1.060
170	23.4	33.0	46.7	73.8	104	181	234	330	572	1.045
175	23.0	32.6	46.0	72.7	103	179	230	326	564	1.030
180	22.7	32.1	45.4	71.7	102	176	227	321	556	1.016
185	22.4	31.7	44.8	70.8	100	174	224	317	548	1.002
190	22.0	31.3	44.2	69.8	98.8	171	221	313	541	0.989
195	21.8	30.9	43.6	68.9	97.5	169	218	309	534	0.975
200	21.5	30.5	43.1	68.1	96.3	167	216	305	527	0.963
205	21.3	30.1	42.5	67.2	95.1	165	213	301	521	0.951
210	21.0	29.7	42.0	66.4	93.9	163	210	297	515	0.940
215	20.8	29.4	41.5	65.7	92.8	161	208	294	509	0.929
220	20.5	29.1	41.1	64.9	91.8	159	206	291	503	0.919
225	20.3	28.7	40.6	64.2	90.7	157	203	287	497	0.908
230	20.1	28.4	40.2	63.5	89.7	156	201	284	492	0.898
235		28.1	39.7	62.8	88.8	154	199	281	487	0.889
240		27.8	39.3	62.1	87.9	152	197	278	482	0.879
245		27.5	38.9	61.5	87.0	151	195	275	477	0.870
250		27.3	38.5	60.9	86.1	149	193	273	472	0.862
255		27.1	38.2	60.3	85.2	148	191	270	467	0.853
260		26.7	37.8	59.7	84.4	146	189	267	463	0.845
265		26.5	37.4	59.2	83.6	145	187	265	458	0.837
270		26.2	37.1	58.6	82.8	144	185	262	454	0.829
275		26.0	36.7	58.1	82.1	142	184	260	450	0.821
280		25.8	36.4	57.5	81.4	141	182	258	446	0.814
285		25.5	36.1	57.0	80.6	140	180	255	442	0.807
290		25.3	35.8	56.5	79.9	139	179	253	438	0.800
295		25.1	35.5	56.1	79.3	137	177	251	434	0.793
300		24.9	35.2	55.6	78.6	136	176	249	431	0.786
310		24.5	36.4	54.7	77.3	134	173	245	424	0.774
320		24.1	34.1	53.8	76.1	132	170	241	417	0.761
330		23.7	33.6	53.0	75.0	130	168	237	411	0.750
340		23.4	33.1	52.2	73.9	128	165	234	405	0.739
350		23.0	32.6	51.5	72.8	126	163	230	399	0.728
360		22.7	32.1	50.8	71.8	124	161	227	393	0.718
370		22.4	31.7	50.1	70.8	123	158	224	388	0.708
380		22.1	31.3	49.4	69.9	121	156	221	383	0.699
390		21.8	30.8	48.8	69.0	119	154	218	378	0.690
400		21.5	30.5	48.2	68.1	118	152	215	373	0.681
410		21.3	30.1	47.6	67.3	116	150	213	369	0.672
420		21.0	29.7	47.0	66.5	115	149	210	364	0.664
430		20.8	29.4	46.5	65.7	114	147	208	360	0.657
440		20.5	29.0	45.9	64.9	112	145	205	356	0.649
450		20.3	28.7	45.4	64.2	111	144	203	352	0.642
460		20.1	28.4	44.9	63.5	110	142	201	348	0.635
470			28.1	44.4	62.8	108	140	199	344	0.628
480			27.8	44.0	62.2	107	139	197	340	0.621
490			27.5	43.5	61.5	106	138	195	337	0.615
500			27.3	43.1	60.9	105	136	193	334	0.609
510			27.0	42.6	60.3	104	135	191	330	0.603
520			26.7	42.2	59.7	103	134	189	327	0.597
530			26.5	41.8	59.2	102	132	187	324	0.591
540			26.2	41.4	58.6	101	131	185	321	0.586
550			26.0	41.1	58.1	100	130	184	318	0.580
560			25.7	40.7	57.6	99.7	129	182	315	0.575
570			25.5	40.3	57.1	98.8	128	180	312	0.570
580			25.3	40.0	56.6	97.9	127	179	310	0.565
590			25.1	39.7	56.1	97.1	125	177	307	0.560
600			24.9	39.3	55.6	96.3	124	176	305	0.556
610			24.7	39.0	55.2	95.5	123	175	302	0.551
620			24.5	38.7	54.7	94.7	122	173	300	0.547
630			24.3	38.4	54.3	94.0	121	172	297	0.542
640			24.1	38.1	53.8	93.2	120	170	295	0.538
650			23.9	37.8	53.4	92.5	119	169	293	0.534
660			23.7	37.5	53.0	91.8	118	168	290	0.530
670			23.5	37.2	52.6	91.1	117	166	288	0.526
680			23.3	36.9	52.2	90.5	116	165	286	0.522
690			23.2	36.7	51.8	89.8	115	164	284	0.518
700			23.0	36.4	51.5	89.2	114	163	282	0.515
720			22.7	35.9	50.8	87.9	113	160	278	0.507
740			22.4	35.4	50.1	86.7	112	158	274	0.500
760			22.1	34.9	49.4	85.6	110	156	271	0.494
780			21.8	34.5	48.8	84.5	109	154	267	0.487
800			21.5	34.0	48.2	83.4	108	152	264	0.481
820			21.3	33.6	47.6	82.4	106	150	261	0.475
840			21.0	33.2	47.0	81.4	105	149	257	0.470
860			20.8	32.8	46.4	80.4	104	147	254	0.464
880			20.5	32.5	45.9	79.5	102	145	251	0.459
900			20.3	32.1	45.4	78.6	101	144	249	0.454
920			20.1	31.8	44.9	77.7	100	142	246	0.449
940			19.9	31.4	44.4	76.9	99.3	140	243	0.444
960			19.7	31.1	44.0	76.1	98.3	139	241	0.439
980			19.4	30.8	43.5	75.4	97.3	138	238	0.435
1000			19.3	30.5	43.1	74.6	96.3	136	236	0.430

ROCKWELL EN ISO 6508

Tensile strength		HV	HBW 30	HRA	HRB	HRC	HRF	HR 45N	HR 30N	HR 15N	HR 45T	HR 30T	HR 15T
				10	10	10	10	3	3	3	3	3	3
N/mm²	(kg/mm²)	≧ 98 N		60	100	150	60	45	30	15	45	30	15
				120°	Ø 1/16"	120°	Ø 1/16"	120°	120°	120°	Ø 1/16"	Ø 1/16"	Ø 1/16"
				100-0	130-0	100-0	130-0	100-0	100-0	100-0	100-0	100-0	100-0
255	26	80	76								5.5	38.0	70.0
270	28	85	80,7		41.0						10.0	41.0	71.0
285	29	90	85,5		48.0		82.6				15.0	44.5	73.0
305	31	95	90,2		52.0						21.5	47.5	74.5
320	33	100	95		56.2		87.0				25.5	50.5	76.0
335	34	105	99,8								28.8	52.5	77.4
350	36	110	105		62.3		90.5				32.5	55.3	78.7
370	38	115	109								35.3	57.0	79.5
385	39	120	114		66.7		93.6				38.8	59.0	80.6
400	41	125	119								41.0	60.8	80.8
415	42	130	124		71.2		96.4				43.5	62.5	82.0
430	44	135	128								45.5	64.0	83.0
450	46	140	133		75.0		99.0				47.5	65.5	84.0
465	47	145	138								49.5	66.5	84.5
480	49	150	143		78.7		(101.4)				51.2	67.7	85.2
495	50	155	147								52.8	69.0	85.9
510	52	160	152		81.7		(103.6)				54.5	69.9	86.4
530	54	165	156								55.8	70.5	87.0
545	56	170	162		85.0		(105.5)				57.2	72.0	87.5
560	57	175	166								58.2	72.7	87.7
575	59	180	171		87.1		(107.2)				59.7	73.5	88.0
595	61	185	176								60.5	74.5	88.7
610	62	190	181		89.5		(108.7)				61.4	75.2	89.0
625	64	195	185								62.4	75.6	89.4
640	65	200	190		91.5		(110.1)				63.4	76.3	89.7
660	67	205	195		92.5						64.0	77.0	90.2
675	69	210	199		93.5		(111.3)				64.8	77.5	90.5
690	70	215	204		94.0						66.0	78.3	90.8
705	72	220	209		95.0		(112.4)				67.0	79.0	91.0
720	73	225	214		96.0						67.6	79.5	91.3
740	75	230	219		96.7		(113.4)				68.5	80.0	91.6
755	77	235	223								69.2	80.5	92.0
770	78	240	228	60.7	98.1	20.3	(114.3)	(19.9)	(41.7)	(69.6)	69.8	81.0	92.3
785	80	245	233	61.2		21.3		21.1	42.5	70.1	70.7	81.4	92.4
800	82	250	238	61.6	99.5	22.2	(115.1)	22.2	43.4	70.6	71.2	81.6	92.5
820	84	255	242	62.0		23.1		23.2	44.2	71.1	71.8	82.0	92.6
835	85	260	247	62.4	(101)	24.0		24.3	45.0	71.6	72.6	82.5	92.8
850	87	265	252	62.7		24.8		25.2	45.7	72.1	72.9	83.0	93.0
865	88	270	257	63.1	(102)	25.6		26.2	46.4	72.6	73.4	83.4	93.2
880	90	275	261	63.5		26.4		27.1	47.2	73.0	74.0	83.8	93.5
900	92	280	266	63.8	(104)	27.1		27.9	47.8	73.4	74.5	84.1	93.8
915	93	285	271	64.2		27.8		28.7	48.4	73.8	75.0	84.5	94.0
930	95	290	276	64.5	(105)	28.5		29.5	49.0	74.2	75.5	84.8	94.2
950	97	295	280	64.8		29.2		30.4	49.7	74.6	76.0	85.0	94.3
965	98	300	285	65.2		29.8		31.1	50.2	74.9	76.4	85.2	94.4
995	101	310	295	65.8		31.0		32.5	51.3	75.6	77.0	85.5	94.5
1030	105	320	304	66.4		32.2		33.9	52.3	76.2			
1060	108	330	314	67.0		33.3		35.2	53.6	76.8			
1095	112	340	323	67.6		34.4		36.5	54.4	77.4			
1125	115	350	333	68.1		35.5		37.8	55.4	78.0			
1155	118	360	342	68.7		36.6		39.1	56.4	78.6			
1190	121	370	352	69.2		37.7		40.4	57.4	79.2			
1220	124	380	361	69.8		38.8		41.7	58.4	79.8			
1255	128	390	371	70.3		39.8		42.9	59.3	80.3			
1290	132	400	380	70.8		40.8		44.1	60.2	80.8			
1320	135	410	390	71.4		41.8		45.3	61.1	81.4			
1350	138	420	399	71.8		42.7		46.4	61.9	81.8			
1385	141	430	409	72.3		43.6		47.4	62.7	82.3			
1420	145	440	418	72.8		44.5		48.4	63.5	82.8			
1455	148	450	428	73.3		45.3		49.4	64.3	83.2			
1485	151	460	437	73.6		46.1		50.4	64.9	83.6			
1520	155	470	447	74.1		46.9		51.3	65.7	83.9			
1555	159	480	456	74.5		47.7		52.2	66.4	84.3			
1595	163	490	466	74.9		48.4		53.1	67.1	84.7			
1630	166	500	475	75.3		49.1		53.9	67.7	85.0			
1665	170	510	485	75.7		49.8		54.7	68.3	85.4			
1700	173	520	494	76.1		50.5		55.6	69.0	85.7			
1740	177	530	504	76.4		51.1		56.2	69.5	86.0			
1775	181	540	513	76.7		51.7		57.0	70.0	86.3			
1810	185	550	523	77.0		52.3		57.8	70.5	86.6			
1845	188	560	532	77.4		53.0		58.6	71.2	86.9			
1880	192	570	542	77.8		53.6		59.3	71.7	87.2			
1920	196	580	551	78.0		54.1		59.9	72.1	87.5			
1955	199	590	561	78.4		54.7		60.5	72.7	87.8			
1995	203	600	570	78.6		55.2		61.2	73.2	88.0			
2030	207	610	580	78.9		55.7		61.7	73.7	88.2			
2070	211	620	589	79.2		56.3		62.4	74.2	88.5			
2105	215	630	599	79.5		56.8		63.0	74.6	88.8			
2145	219	640	608	79.8		57.3		63.5	75.1	89.0			
2180	222	650	618	80.0		57.8		64.1	75.5	89.2			
		660		80.3		58.3		64.7	75.9	89.5			
		670		80.6		58.8		65.3	76.4	89.7			
		680		80.8		59.2		65.7	76.8	89.8			
		690		81.1		59.7		66.2	77.2	90.1			
		700		81.3		60.1		66.7	77.6	90.3			
		720		81.8		61.0		67.7	78.4	90.7			
		740		82.2		61.8		68.6	79.1	91.0			
		760		82.6		62.5		69.4	79.7	91.2			
		780		83.0		63.3		70.2	80.4	91.5			
		800		83.4		64.0		71.0	81.1	91.8			
		820		83.8		64.7		71.8	81.7	92.1			
		840		84.1		65.3		72.2	82.2	92.3			
		860		84.4		65.9		73.1	82.7	92.5			
		880		84.7		66.4		73.6	83.1	92.7			
		900		85.0		67.0		74.2	83.6	92.9			
		920		85.3		67.5		74.8	84.0	93.0			
		940		85.6		68.0		75.4	84.4	93.2			
		960											
		980											
		1000											

BRINELL EN ISO 6506

HBW 30	Ø 10 3000	Ø 5 750	Ø 2.5 187.5	HBW 10	Ø 10 1000	Ø 5 250	Ø 2.5 62.5	HBW 5	Ø 10 500	Ø 5 125	Ø 2.5 31.25	HBW 2.5	Ø 5 62.5	Ø 2.5 15.625	Ø 1 2.5	HBW 1	Ø 5 25	Ø 2.5 6.25	Ø 1 1
	$d = \frac{d_1 + d_2}{2}$				$d = \frac{d_1 + d_2}{2}$				$d = \frac{d_1 + d_2}{2}$				$d = \frac{d_1 + d_2}{2}$				$d = \frac{d_1 + d_2}{2}$		
	d				d				d				d				d		
	mm	mm	mm		mm	mm	mm		mm	mm	mm		mm	mm	µm		mm	mm	µm
95.5	6.00	3.00	1.50	31.8	6.00	3.00	1.50	15.9	6.00	3.00	1.50	7.96	3.00	1.50	600	3.18	3.00	1.50	600
96.9	5.96	2.98	1.49	32.3	5.96	2.98	1.49	16.2	5.96	2.98	1.49	8.08	2.98	1.49	596	3.23	2.98	1.49	596
98.4	5.92	2.96	1.48	32.8	5.92	2.96	1.48	16.4	5.92	2.96	1.48	8.20	2.96	1.48	592	3.28	2.96	1.48	592
99.9	5.88	2.94	1.47	33.3	5.88	2.94	1.47	16.7	5.88	2.94	1.47	8.33	2.94	1.47	588	3.33	2.94	1.47	588
101	5.84	2.92	1.46	33.8	5.84	2.92	1.46	16.9	5.84	2.92	1.46	8.45	2.92	1.46	584	3.38	2.92	1.46	584
103	5.80	2.90	1.45	34.3	5.80	2.90	1.45	17.2	5.80	2.90	1.45	8.59	2.90	1.45	580	3.43	2.90	1.45	580
105	5.76	2.88	1.44	34.9	5.76	2.88	1.44	17.4	5.76	2.88	1.44	8.72	2.88	1.44	576	3.49	2.88	1.44	576
106	5.72	2.86	1.43	35.4	5.72	2.86	1.43	17.7	5.72	2.86	1.43	8.85	2.86	1.43	572	3.54	2.86	1.43	572
108	5.68	2.84	1.42	36.0	5.68	2.84	1.42	18.0	5.68	2.84	1.42	8.99	2.84	1.42	568	3.60	2.84	1.42	568
110	5.64	2.82	1.41	36.5	5.64	2.82	1.41	18.3	5.64	2.82	1.41	9.14	2.82	1.41	564	3.65	2.82	1.41	564
111	5.60	2.80	1.40	37.1	5.60	2.80	1.40	18.6	5.60	2.80	1.40	9.28	2.80	1.40	560	3.71	2.80	1.40	560
113	5.56	2.78	1.39	37.7	5.56	2.78	1.39	18.9	5.56	2.78	1.39	9.43	2.78	1.39	556	3.77	2.78	1.39	556
115	5.52	2.76	1.38	38.3	5.52	2.76	1.38	19.2	5.52	2.76	1.38	9.58	2.76	1.38	552	3.83	2.76	1.38	552
117	5.48	2.74	1.37	38.9	5.48	2.74	1.37	19.5	5.48	2.74	1.37	9.73	2.74	1.37	548	3.89	2.74	1.37	548
119	5.44	2.72	1.36	39.6	5.44	2.72	1.36	19.8	5.44	2.72	1.36	9.89	2.72	1.36	544	3.96	2.72	1.36	544
121	5.40	2.70	1.35	40.2	5.40	2.70	1.35	20.1	5.40	2.70	1.35	10.1	2.70	1.35	540	4.02	2.70	1.35	540
123	5.36	2.68	1.34	40.9	5.36	2.68	1.34	20.4	5.36	2.68	1.34	10.2	2.68	1.34	536	4.09	2.68	1.34	536
125	5.32	2.66	1.33	41.5	5.32	2.66	1.33	20.8	5.32	2.66	1.33	10.4	2.66	1.33	532	4.15	2.66	1.33	532
127	5.28	2.64	1.32	42.2	5.28	2.64	1.32	21.1	5.28	2.64	1.32	10.6	2.64	1.32	528	4.22	2.64	1.32	528
129	5.24	2.62	1.31	42.9	5.24	2.62	1.31	21.5	5.24	2.62	1.31	10.7	2.62	1.31	524	4.29	2.62	1.31	524
131	5.20	2.60	1.30	43.7	5.20	2.60	1.30	21.8	5.20	2.60	1.30	10.9	2.60	1.30	520	4.37	2.60	1.30	520
133	5.16	2.58	1.29	44.4	5.16	2.58	1.29	22.2	5.16	2.58	1.29	11.1	2.58	1.29	516	4.44	2.58	1.29	516
135	5.12	2.56	1.28	45.1	5.12	2.56	1.28	22.6	5.12	2.56	1.28	11.3	2.56	1.28	512	4.51	2.56	1.28	512
138	5.08	2.54	1.27	45.9	5.08	2.54	1.27	23.0	5.08	2.54	1.27	11.5	2.54	1.27	508	4.59	2.54	1.27	508
140	5.04	2.52	1.26	46.7	5.04	2.52	1.26	23.4	5.04	2.52	1.26	11.7	2.52	1.26	504	4.67	2.52	1.26	504
143	5.00	2.50	1.25	47.5	5.00	2.50	1.25	23.8	5.00	2.50	1.25	11.9	2.50	1.25	500	4.75	2.50	1.25	500
145	4.96	2.48	1.24	48.3	4.96	2.48	1.24	24.2	4.96	2.48	1.24	12.1	2.48	1.24	496	4.83	2.48	1.24	496
148	4.92	2.46	1.23	49.2	4.92	2.46	1.23	24.6	4.92	2.46	1.23	12.3	2.46	1.23	492	4.92	2.46	1.23	492
150	4.88	2.44	1.22	50.1	4.88	2.44	1.22	25.0	4.88	2.44	1.22	12.5	2.44	1.22	488	5.01	2.44	1.22	488
153	4.84	2.42	1.21	51.0	4.84	2.42	1.21	25.5	4.84	2.42	1.21	12.7	2.42	1.21	484	5.10	2.42	1.21	484
156	4.80	2.40	1.20	51.9	4.80	2.40	1.20	25.9	4.80	2.40	1.20	13.0	2.40	1.20	480	5.19	2.40	1.20	480
158	4.76	2.38	1.19	52.8	4.76	2.38	1.19	26.4	4.76	2.38	1.19	13.2	2.38	1.19	476	5.28	2.38	1.19	476
161	4.72	2.36	1.18	53.8	4.72	2.36	1.18	26.9	4.72	2.36	1.18	13.4	2.36	1.18	472	5.38	2.36	1.18	472
164	4.68	2.34	1.17	54.8	4.68	2.34	1.17	27.4	4.68	2.34	1.17	13.7	2.34	1.17	468	5.48	2.34	1.17	468
167	4.64	2.32	1.16	55.8	4.64	2.32	1.16	27.9	4.64	2.32	1.16	13.9	2.32	1.16	464	5.58	2.32	1.16	464
170	4.60	2.30	1.15	56.8	4.60	2.30	1.15	28.4	4.60	2.30	1.15	14.2	2.30	1.15	460	5.68	2.30	1.15	460
174	4.56	2.28	1.14	57.9	4.56	2.28	1.14	28.9	4.56	2.28	1.14	14.5	2.28	1.14	456	5.79	2.28	1.14	456
177	4.52	2.26	1.13	59.0	4.52	2.26	1.13	29.5	4.52	2.26	1.13	14.7	2.26	1.13	452	5.90	2.26	1.13	452
180	4.48	2.24	1.12	60.1	4.48	2.24	1.12	30.0	4.48	2.24	1.12	15.0	2.24	1.12	448	6.01	2.24	1.12	448
184	4.44	2.22	1.11	61.2	4.44	2.22	1.11	30.6	4.44	2.22	1.11	15.3	2.22	1.11	444	6.12	2.22	1.11	444
187	4.40	2.20	1.10	62.4	4.40	2.20	1.10	31.2	4.40	2.20	1.10	15.6	2.20	1.10	440	6.24	2.20	1.10	440
191	4.36	2.18	1.09	63.6	4.36	2.18	1.09	31.8	4.36	2.18	1.09	15.9	2.18	1.09	436	6.36	2.18	1.09	436
195	4.32	2.16	1.08	64.9	4.32	2.16	1.08	32.4	4.32	2.16	1.08	16.2	2.16	1.08	432	6.49	2.16	1.08	432
198	4.28	2.14	1.07	66.2	4.28	2.14	1.07	33.1	4.28	2.14	1.07	16.5	2.14	1.07	428	6.62	2.14	1.07	428
202	4.24	2.12	1.06	67.5	4.24	2.12	1.06	33.7	4.24	2.12	1.06	16.9	2.12	1.06	424	6.75	2.12	1.06	424
207	4.20	2.10	1.05	68.8	4.20	2.10	1.05	34.4	4.20	2.10	1.05	17.2	2.10	1.05	420	6.88	2.10	1.05	420
211	4.16	2.08	1.04	70.2	4.16	2.08	1.04	35.1	4.16	2.08	1.04	17.6	2.08	1.04	416	7.02	2.08	1.04	416
215	4.12	2.06	1.03	71.7	4.12	2.06	1.03	35.8	4.12	2.06	1.03	17.9	2.06	1.03	412	7.17	2.06	1.03	412
219	4.08	2.04	1.02	73.2	4.08	2.04	1.02	36.6	4.08	2.04	1.02	18.3	2.04	1.02	408	7.32	2.04	1.02	408
224	4.04	2.02	1.01	74.7	4.04	2.02	1.01	37.3	4.04	2.02	1.01	18.7	2.02	1.01	404	7.47	2.02	1.01	404
229	4.00	2.00	1.00	76.3	4.00	2.00	1.00	38.1	4.00	2.00	1.00	19.1	2.00	1.00	400	7.63	2.00	1.00	400
234	3.96	1.98	0.99	77.9	3.96	1.98	0.99	38.9	3.96	1.98	0.99	19.5	1.98	0.99	396	7.79	1.98	0.99	396
239	3.92	1.96	0.98	79.5	3.92	1.96	0.98	39.8	3.92	1.96	0.98	19.9	1.96	0.98	392	7.95	1.96	0.98	392
244	3.88	1.94	0.97	81.3	3.88	1.94	0.97	40.6	3.88	1.94	0.97	20.3	1.94	0.97	388	8.13	1.94	0.97	388
249	3.84	1.92	0.96	83.0	3.84	1.92	0.96	41.5	3.84	1.92	0.96	20.8	1.92	0.96	384	8.30	1.92	0.96	384
255	3.80	1.90	0.95	84.9	3.80	1.90	0.95	42.4	3.80	1.90	0.95	21.2	1.90	0.95	380	8.49	1.90	0.95	380
260	3.76	1.88	0.94	86.8	3.76	1.88	0.94	43.4	3.76	1.88	0.94	21.7	1.88	0.94	376	8.68	1.88	0.94	376
266	3.72	1.86	0.93	88.7	3.72	1.86	0.93	44.4	3.72	1.86	0.93	22.2	1.86	0.93	372	8.87	1.86	0.93	372
272	3.68	1.84	0.92	90.7	3.68	1.84	0.92	45.4	3.68	1.84	0.92	22.7	1.84	0.92	368	9.07	1.84	0.92	368
278	3.64	1.82	0.91	92.8	3.64	1.82	0.91	46.4	3.64	1.82	0.91	23.2	1.82	0.91	364	9.28	1.82	0.91	364
285	3.60	1.80	0.90	95.0	3.60	1.80	0.90	47.5	3.60	1.80	0.90	23.7	1.80	0.90	360	9.50	1.80	0.90	360
292	3.56	1.78	0.89	97.2	3.56	1.78	0.89	48.6	3.56	1.78	0.89	24.3	1.78	0.89	356	9.72	1.78	0.89	356
298	3.52	1.76	0.88	99.5	3.52	1.76	0.88	49.7	3.52	1.76	0.88	24.9	1.76	0.88	352	9.95	1.76	0.88	352
306	3.48	1.74	0.87	102	3.48	1.74	0.87	50.9	3.48	1.74	0.87	25.5	1.74	0.87	348	10.2	1.74	0.87	348
313	3.44	1.72	0.86	104	3.44	1.72	0.86	52.2	3.44	1.72	0.86	26.1	1.72	0.86	344	10.4	1.72	0.86	344
321	3.40	1.70	0.85	107	3.40	1.70	0.85	53.4	3.40	1.70	0.85	26.7	1.70	0.85	340	10.7	1.70	0.85	340
329	3.36	1.68	0.84	110	3.36	1.68	0.84	54.8	3.36	1.68	0.84	27.4	1.68	0.84	336	11.0	1.68	0.84	336
337	3.32	1.66	0.83	112	3.32	1.66	0.83	56.1	3.32	1.66	0.83	28.1	1.66	0.83	332	11.2	1.66	0.83	332
345	3.28	1.64	0.82	115	3.28	1.64	0.82	57.5	3.28	1.64	0.82	28.8	1.64	0.82	328	11.5	1.64	0.82	328
354	3.24	1.62	0.81	118	3.24	1.62	0.81	59.0	3.24	1.62	0.81	29.5	1.62	0.81	324	11.8	1.62	0.81	324
363	3.20	1.60	0.80	121	3.20	1.60	0.80	60.5	3.20	1.60	0.80	30.3	1.60	0.80	320	12.1	1.60	0.80	320
373	3.16	1.58	0.79	124	3.16	1.58	0.79	62.1	3.16	1.58	0.79	31.1	1.58	0.79	316	12.4	1.58	0.79	316
383	3.12	1.56	0.78	128	3.12	1.56	0.78	63.8	3.12	1.56	0.78	31.9	1.56	0.78	312	12.8	1.56	0.78	312
393	3.08	1.54	0.77	131	3.08	1.54	0.77	65.5	3.08	1.54	0.77	32.7	1.54	0.77	308	13.1	1.54	0.77	308
404	3.04	1.52	0.76	135	3.04	1.52	0.76	67.3	3.04	1.52	0.76	33.6	1.52	0.76	304	13.5	1.52	0.76	304
415	3.00	1.50	0.75	138	3.00	1.50	0.75	69.1	3.00	1.50	0.75	34.6	1.50	0.75	300	13.8	1.50	0.75	300
426	2.96	1.48	0.74	142	2.96	1.48	0.74	71.0	2.96	1.48	0.74	35.5	1.48	0.74	296	14.2	1.48	0.74	296
438	2.92	1.46	0.73	146	2.92	1.46	0.73	73.0	2.92	1.46	0.73	36.5	1.46	0.73	292	14.6	1.46	0.73	292
451	2.88	1.44	0.72	150	2.88	1.44	0.72	75.1	2.88	1.44	0.72	37.6	1.44	0.72	288	15.0	1.44	0.72	282
464	2.84	1.42	0.71	155	2.84	1.42	0.71	77.3	2.84	1.42	0.71	38.7	1.42	0.71	284	15.5	1.42	0.71	281
477	2.80	1.40	0.70	159	2.80	1.40	0.70	79.6	2.80	1.40	0.70	39.8	1.40	0.70	280	15.9	1.40	0.70	280
492	2.76	1.38	0.69	164	2.76	1.38	0.69	81.9	2.76	1.38	0.69	41.0	1.38	0.69	276	16.4	1.38	0.69	276
507	2.72	1.36	0.68	169	2.72	1.36	0.68	84.4	2.72	1.36	0.68	42.2	1.36	0.68	272	16.9	1.36	0.68	272
522	2.68	1.34	0.67	174	2.68	1.34	0.67	87.0	2.68	1.34	0.67	43.5	1.34	0.67	268	17.4	1.34	0.67	268
538	2.64	1.32	0.66	179	2.64	1.32	0.66	89.7	2.64	1.32	0.66	44.9	1.32	0.66	264	17.9	1.32	0.66	264
555	2.60	1.30	0.65	185	2.60	1.30	0.65	92.6	2.60	1.30	0.65	46.3	1.30	0.65	260	18.5	1.30	0.65	260
573	2.56	1.28	0.64	191	2.56	1.28	0.64	95.5	2.56	1.28	0.64	47.8	1.28	0.64	256	19.1	1.28	0.64	256
592	2.52	1.26	0.63	197	2.52	1.26	0.63	98.6	2.52	1.26	0.63	49.3	1.26	0.63	252	19.7	1.26	0.63	252
611	2.48	1.24	0.62	204	2.48	1.24	0.62	102	2.48	1.24	0.62	50.9	1.24	0.62	248	20.4	1.24	0.62	248
632	2.44	1.22	0.61	211	2.44	1.22	0.61	105	2.44	1.22	0.61	52.7	1.22	0.61	244	21.1	1.22	0.61	244
653	2.40	1.20	0.60	218	2.40	1.20	0.60	109	2.40	1.20	0.60	54.5	1.20	0.60	240	21.8	1.20	0.60	240

Rockwell	Hardness of test block	Deviation in Rockwell units (HR)	Permissible repeatability of the testing machine
HRA	20 to ≤ 75 HRA	± 2 HRA	0.8 HRA
	> 75 to ≤ 88 HRA	± 1.5 HRA	
HRB	20 to ≤ 45 HRB	± 4 HRB	1.2 HRB
	> 45 to ≤ 80 HRB	± 3 HRB	
	> 80 to ≤ 100 HRB	± 2 HRB	
HRC	20 to ≤ 70 HRC	± 1.5 HRC	0.8 HRC
HRF	60 to ≤ 90 HRF	± 3 HRF	1.2 HRF
	> 90 to ≤ 100 HRF	± 2 HRF	
HR45N HR30N HR15N	20 to 70 HR 45N 42 to 80 HR 30N 70 to 91 HR 15N	± 2 HRN	1.2 HRN
HR45T HR30T HR15T	12 to 72 HR 45T 43 to 82 HR 30T 73 to 93 HR 15T	± 3 HRT	2.4 HRT

Permissible repeatability of the testing machine

Hardness of test block HV[b]	HV 5 to HV 100	HV 0.2 to < HV 5	< HV 0.2
≤ 225 HV	0.03[a]	0.06[a]	0.06[a]
> 225 HV	0.02[a]	0.04[a]	0.05[a]

[a] or 0,001 mm, the higher value should be chosen

[b] HV, Vickers hardness

HV 0.2 to < HV 5		HV 5 to HV 100	
Hardness of test block	HV	Hardness of test block	HV
100	12	100	6
200	24	200	12
250	20	250	8
350	28	350	11
600	48	600	24
750	60	750	30

Max. deviation of the testing machine in %

VICKERS	HV 100	200	300	400	500	600	700	800	900	1000	1500
HV 0.05	8	10									
HV 0.1		8	9	10							
HV 0.2	6	6	8	9	10	11	11	12	12		
HV 0.3	4	5	6	7	8	9	10	10	11	11	
HV 0.5	4	5	5	6	6	7	7	8	8	9	11
HV 1	3	4	4	4	5	5	5	6	6	6	8
HV 2	3	3	3	4	4	4	4	4	5	5	6
HV 3	3	3	3	3	3	4	4	4	4	4	5
HV 5	3	3	3	3	3	3	3	3	3	4	4
HV 10	3	3	3	3	3	3	3	3	3	3	3
HV 20	3	3	3	3	3	3	3	3	3	3	3
HV 30	3	3	2	2	2	2	2	2	2	2	2
HV 50	3	3	2	2	2	2	2	2	2	2	2

Permissible repeatability and deviation of the testing machine

Hardness of the reference block HBW[a]	Permissible repeatability r_{rel} of the testing machine %	Permissible error E_{rel} of the testing machine %
≤ 125	3.0	± 3.0
125 < HBW ≤ 225	2.5	± 2.5
> 225	2.0	± 2.0

[a] HBW: Brinell Hardness

The error, *E*, of the testing machine under the particular verification conditions is calculated by the following formula:

$$E = \overline{H} - H_C$$

The percent error, E_{rel}, is calculated by the following equation:

$$E_{rel} = 100 \times \frac{\overline{H} - Hc}{Hc}, \text{ in } \%$$

where H_C is the reported certified hardness value of the reference block.

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