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TWIN Rockwell Hardness Tester

Model No. 3815

Operation Manual



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TWIN Rockwell Hardness Tester

Operating Instructions & Parts Manual

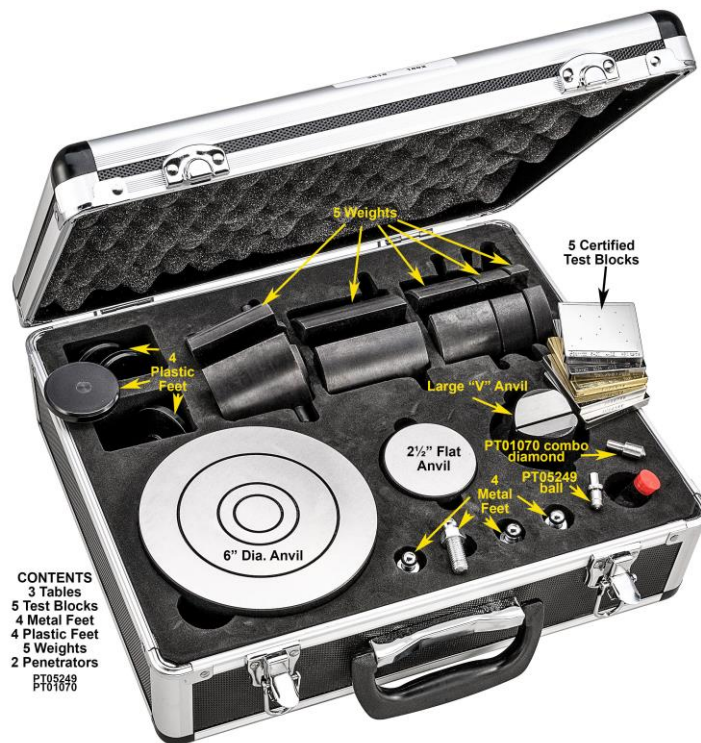
Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the products described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain Instructions for future reference.

Description

The 3815 Hardness Tester accurately measures hardness of materials in standard Rockwell scales as well as Superficial Rockwell scales. Heat-treated steels are tested using a 120° diamond indenter. Soft/thin materials are tested using a 1/16" carbide ball indenter. This tester features a weight adjustment knob for quick and easy adjustments between different scales. Release/reset lever is provided for quick and accurate testing.

Tool Kit Accessories:

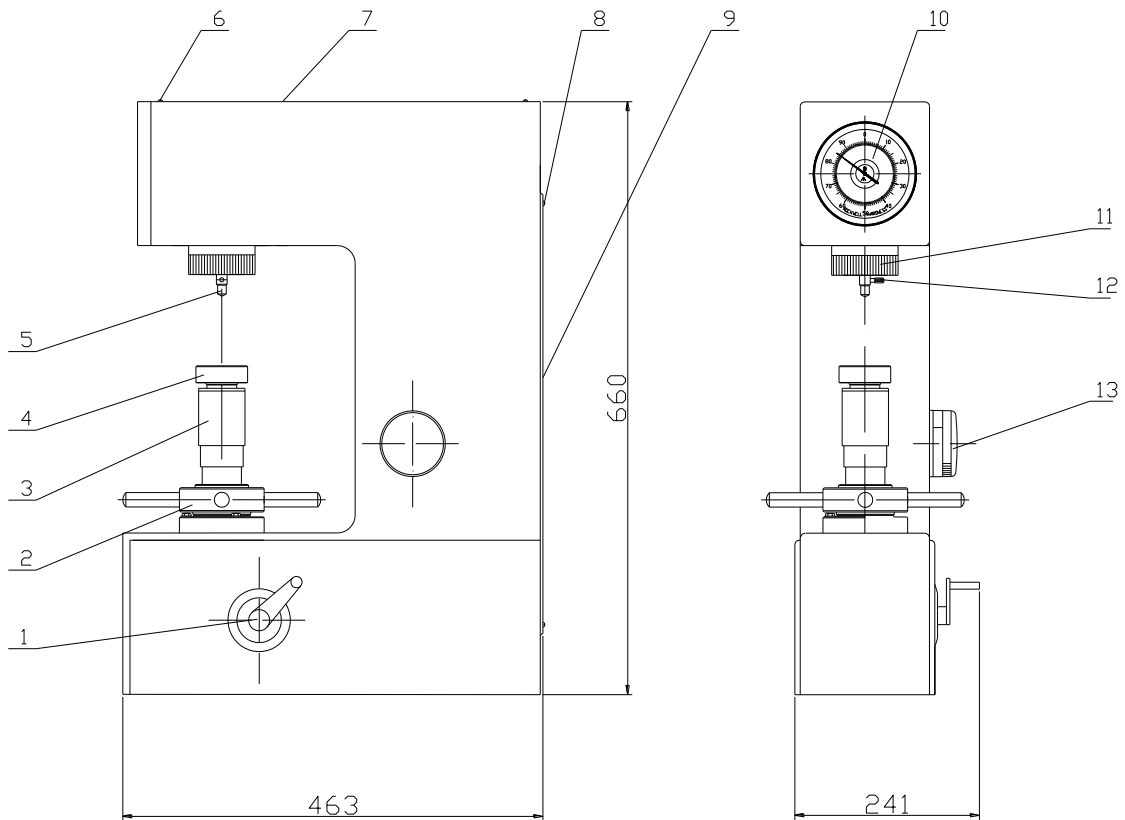
- A. Large Anvil
- B. V-shaped Anvil
- C. Small Round Anvil
- D. Spot Anvil
- E. 5 Rockwell Test Blocks
 - 1. Two each, HRC
 - 2. One each, HRB
 - 3. Two each, HRN
 - 4. One each, HRT
- F. 120° Diamond Indenter
- G. 1/16" Carbide Ball indenter
- H. Machine Cover
- I. Set of leveling Feet
- J. 5-Weights



IMPORTANT!

Do Not Discard Shipping Crate as This May
be Needed for Future Transportation.

Operating Instructions & Parts Manual



- 1.** Load/Unload Handle **2.** Handwheel **3.** Elevation Screw Cover
4. Anvil **5.** Indenter **6.** Screw for cover **7.** Top cover
8. Screw for rear cover **9.** Rear cover **10.** Indicator
11. Rockwell "R"—Surface Rockwell "SR" conversion dial
12. Indenter Locking Screw **13.** Weight Selector Knob

General Safety Instructions

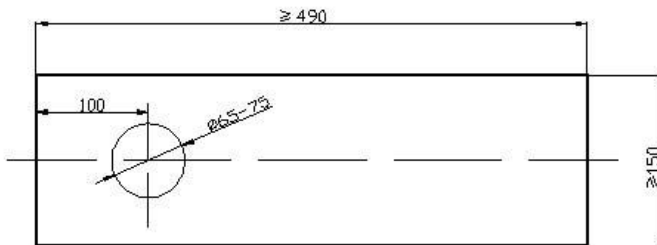
1. Never use clamps, straps, any other tooling or equipment to mount specimen to the tester anvil.
2. Always use the proper anvil supplied.
3. Be sure to use proper indenter and weight for material and hardness to be tested. (See Figure 3).

Hardness Tester Should Be Maintained

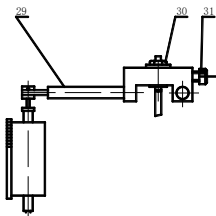
1. Consult operation instructions for specific maintaining and adjusting procedures.
2. Keep the tool clean for best results.
3. Remove adjusting tools and wrenches. Form habit of checking that adjusting tools are removed before using machine.
4. Keep all parts in working order. Check to determine that the parts will operate properly and perform their intended function.
5. Check for damaged parts. Check for alignment, binding, breakage, mounting and any other condition that may affect tool's operation.
6. Part that is damaged should be properly repaired or replaced. Do not perform makeshift repairs. (Use the parts list provided to order replacement parts.)

Basic Set-Up Information:

- 1) Remove Top crate cover from base. Carefully lift straight up to avoid scratching the side of the machine
- 2) Remove the tool kit and manual from the base of the crate
- 3) Remove plastic machine cover
- 4) With assistance, remove the two bolts under the base of the crate to remove the machine from the base.
- 5) Place machine on a sturdy vibration free table or bench. Bench should be rated for up to 500lbs.
- 6) It is recommended that the machine gets bolted to the table. To do this you should reference Figure 1 shown below



- 7) In order for the elevation screw to be lowered to accept maximum size part, you must drill a hole in the table to allow the elevation screw to travel through. Diagram shown above.
- 8) Remove top cover and remove white string from extension rod (shown below). Replace Cover



Operating Instructions & Parts Manual

- 9) Remove back cover and begin to remove white string from all moving parts
- 10) Place weights on weight bar in order as shown below
- 11) Proceed to lower the main lead screw and remove the rubber block that is protecting the indenter housing
- 12) **Clean and lubricate the lead screw using light duty spindle oil.** The best way to do this is lower the elevation screw and then unscrew the handwheel from the elevation screw. Wipe down all surfaces, lightly coat with oil and put the handwheel back on the elevation screw.
- 13) Be sure tester is level both front/back and left/right to 0.002 in/in.

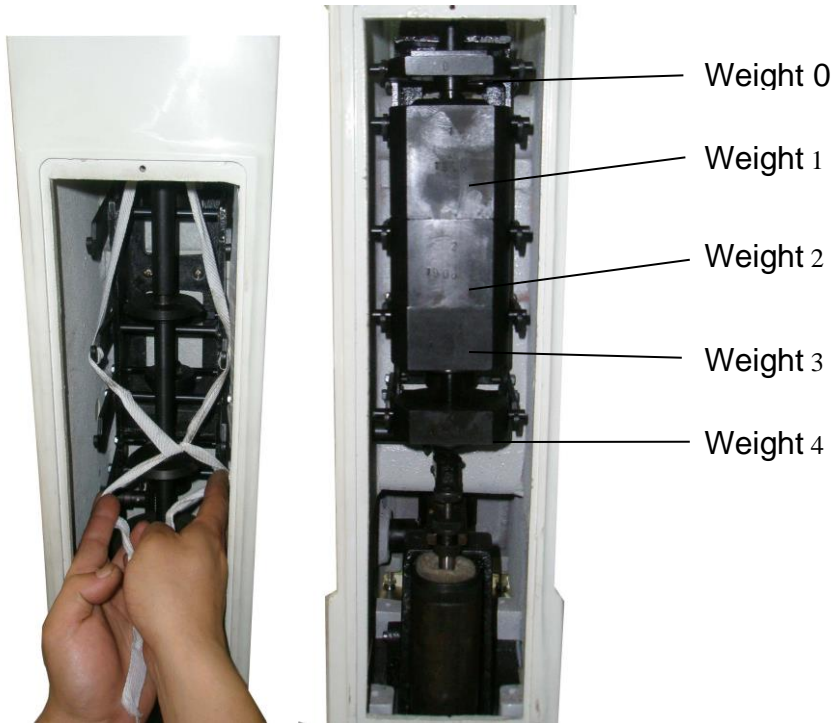


Figure 2

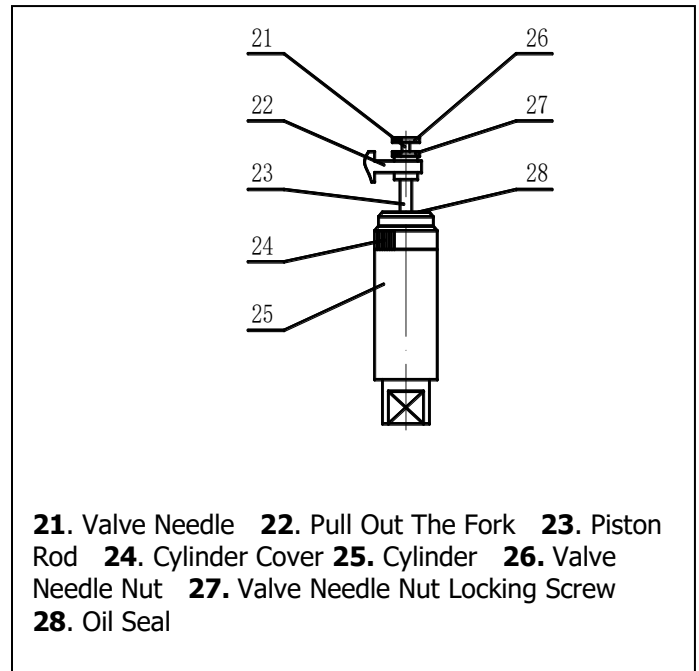


Figure 3

How to fill oil in the dashpot (Figure 3)

The cylinder is filled with oil at the factory. In case of oil leakage during transportation, user can refill the dashpot by following these simple instructions:

- a) loosen and take off two (8) screws on rear cover (9),
- b) remove the cover and push the pressure applying handle (1) forward. (see Figure
- c) Lift up felt cover(28) and fill machine oil slowly.
- d) Use good quality light duty hydraulic oil

Note : the oil level shall not exceed the joint surface between cylinder cover and cylinder body, otherwise oil will leak out.

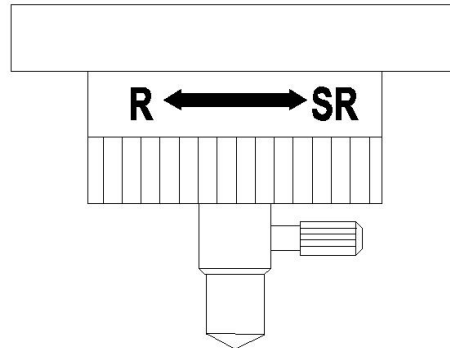
Operating Instructions & Parts Manual

Operation:

1. Determine the proper indenter, scale and weight for the material hardness to be tested (**see charts in back of manual**) Mount the required indenter in the indenter holder using the set screw on the side of the holder.
2. Set Preliminary test force setting using dial shown below.

R = Standard Rockwell scales

SR = Superficial Rockwell scales



Seating Your Diamond:

Caution: To ensure accuracy, mount the indenter by sliding it in the holder as far as possible and then securing the indenter by tightening the set screw finger-tight only.

Place HRC test block on the small round anvil and begin by turning the handwheel clockwise until the block just touches the diamond. At this point, continue rotating the handwheel until the large needle goes around approx. 3 revolutions. Let the machine sit idle for a few seconds and then loosen the set screw. Wait a few more seconds and then tighten the set screw back up. This will allow the diamond to be “seated” in the shank. Take the load off by turning the handwheel counter-clockwise and you can begin following instructions below.

Rotate the weight adjustment knob until the required weight scale is aligned with the alignment mark on the frame of the machine.

3. Prepare the test specimen properly. Be sure that the top and bottom surfaces of the specimen are clean and free of any grease, oil dirt, etc and free of any burrs or debris.
4. For small specimens (under 3" maximum length or diameter) use the small round anvil. Use the large anvil for larger specimens. Use the V-shaped anvil for round or curved specimens.

Warning: Do not test any specimen that cannot be safely and properly positioned on and supported by the tester anvil.

Test Procedure

Test procedure consists of a preload of the specimen using the force of the elevation screw and a test load using the weights and lever arm assembly. Be sure that the weight reset handle is in rest (“unload”) position.

1. Mount specimen on required anvil. Rotate the elevation screw threaded collar clockwise slowly until the specimen contacts the indenter. Be sure to position specimen so the indenter contacts clean, untested material.
2. Preload the specimen by rotating the leadscrew collar slowly until the large needle on the dial indicator rotates two to three (2-3) revolutions. Stop rotation of handwheel when the large needle is within 3 hash marks of vertical (TDC)

Caution: As the large needle is properly rotated 2-3 revolutions, the small needle rotates counterclockwise 90° to vertical at the red dot. If the large needle overshoots vertical by more than 5 hash marks, the test is invalid and must be repeated from step 1.

3. Rotate the bezel so that the hash mark at the “0” mark at the top of the dial is aligned with the large needle.
4. Pull the weight release handle to apply the major load. Wait until the large needle stops rotating, approx. 5-8 seconds. This 5-8 second “dwell” time can be adjusted by turning valve on dashpot.
5. Slowly push the weight reset handle back until it resets and locks in the reset position.
6. Read the material hardness from the required scale on the dial.
7. Rotate the handwheel counterclockwise to lower and release the specimen.

Fine Adjustment:

Although the hardness tester has been calibrated at the factory, transportation can sometimes cause the machine to be slightly out of tolerance. Therefore it is suggested that the end user make slight adjustments to bring the machine back into the allowable tolerance.

Please be sure to make very slight adjustments when calibrating the 3815 as this machine is extremely sensitive to any movement.

Remove the top cover off the 3815.

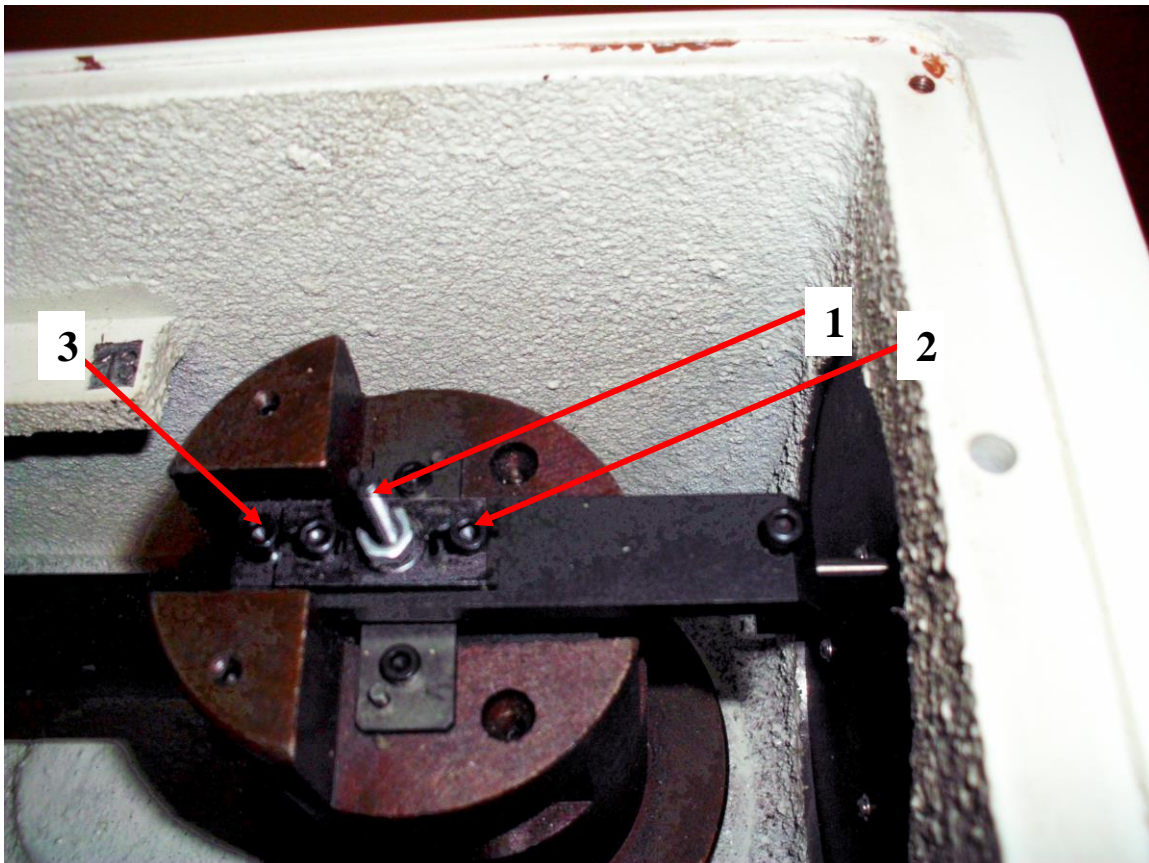
Always test first in Rockwell C scale. Install diamond indenter and set weight selector to 150kg(1471N).

Adjusting the set screw that controls the Indicator needle starting point:

Carefully hold the #1 set screw with a thin blade regular screwdriver. While holding this screw steady, carefully loosen the set screw hex nut. Slightly turn the set screw until the Large needle on the dial is between 3-5 hash marks to the LEFT of the "0".

Take a minimum of 3 tests on your test block to make sure the machine is reading correctly. If readings are low, you must loosen Allan screw #2 & #3 as shown below and gently slide the plate towards the front of the machine. if the readings were high then you must move the plate slightly towards the back of the machine. Take 3 more tests on each block to verify your readings are within the allowable tolerance. If still out then you must repeat the steps above.

Please see picture below:



Operating Instructions & Parts Manual

Maintenance

1. If large needle on the dial indicator rotates suddenly at first and then slows during a test, then the dash pot may be low on oil. To fill the dash pot, go to Page 5 in this manual and follow instructions. Bleed the air from the dash pot by manually raising and lowering the dash pot piston until all air bubbles have been released from under the piston.
2. Be sure elevation screw and threaded collar are clean and lubricated. Lubricate with general purpose wheel bearing grease.
3. Keep top of leadscrew, collar and anvils clean and free of grease, oil, dirt, burrs, etc.
4. Use the test blocks periodically to check tester accuracy.

Troubleshooting Chart

Symptom	Possible cause(s)	Corrective Action
Incorrect hardness measurement	<ol style="list-style-type: none"> 1. Contaminants effecting measurement 2. Elevation screw cover & top, are interfering with specimen, anvil or elevation screw. 3. Indentor is damaged. 4. Dash pot is low on oil. 	<ol style="list-style-type: none"> 1. Be sure the anvil, top of elevation screw, threaded collar, indentor and specimen are all clean and free of oil, grease, dirt, shavings, debris, etc. 2. Be sure elevation screw cover and top is clean and free of any dirt, oil, grease, etc. Position cover properly on the elevation screw. 3. Inspect indentor for damage, replace diamond indentor if chipped or broken, replace 1/16" carbide ball if deformed or damaged. 4. Refill dash pot, see Maintenance, above.
When using the test block, a different hardness is measured at different locations on the block.	<ol style="list-style-type: none"> 1. Burrs on bottom of test block. 2. Air trapped under test block. 	<ol style="list-style-type: none"> 1. Use oil sharpening stone to remove burrs. 2. When testing different locations on a test block, slide test block on anvil, maintaining contact between anvil and block.
Dial indicator needle rotates too fast at start of test	<ol style="list-style-type: none"> 1. Dash pot is low on oil. 	<ol style="list-style-type: none"> 1. Refill dash pot See Maintenance, above.

Operating Instructions & Parts Manual

Approximate Hardness Conversion Numbers for Non-Austenitic Steels (Rockwell C Hardness Range)^A

Rockwell C 150kgf (HRC)	Vickers (HV)	Brinell Hardness Number ^c		Knoop 500-gf and Over (HK)	Rockwell		Superficial Rockwell Number			Scleroscope Hardness _s
		10-mm Standard ball 3000kgf (HBS)	10-mm Carbide ball 3000kgf (HBW)		A Scale 60 kgf (HRA)	D Scale 100kgf (HRD)	15-N Scale 15-kgf (HR15N)	30-N Scale 30-kgf (HR30N)	45-N Scale 45-kgf (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	73.3	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	86.5
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	57.4	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	455	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	46.7	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	68.9	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	24.3	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

Operating Instructions & Parts Manual

Approximate Hardness Conversion Numbers for Non-Austenitic Steels (Rockwell B Hardness Range)^A

Rockwell B 100kgf (HRB)	Vickers (HV)	10-mm Standard ball 3000kgf (HBS)	Knoop 500-gf and Over (HK)	Rockwell Superficial Rockwell Number				
				A Scale 60 kgf (HRA)	F Scale 60kgf (HRF)	15-T Scale 15-kgf (HR15T)	30-T Scale 30-kgf (HR30T)	45-T Scale 45-kgf (HR45T)
100	240	240	251	61.5	...	93.1	83.1	72.9
99	234	234	246	60.9	...	92.8	82.5	71.9
98	228	228	241	60.2	...	92.5	81.8	70.9
97	222	222	236	59.5	...	92.1	81.1	69.9
96	216	216	231	58.9	...	91.8	80.4	68.9
95	210	210	226	58.3	...	91.5	79.8	67.9
94	205	205	221	57.6	...	91.2	79.1	66.9
93	200	200	216	57.0	...	90.8	78.4	65.9
92	195	195	211	56.4	...	90.5	77.8	64.8
91	190	190	206	55.8	...	90.2	77.1	63.8
90	185	185	201	55.2	...	89.9	76.4	62.8
89	180	180	196	54.6	...	89.5	75.8	61.8
88	176	176	192	54.0	...	89.2	75.1	60.8
87	172	172	188	53.4	...	88.9	74.4	59.8
86	169	169	184	52.8	...	88.6	73.8	58.8
85	165	165	180	52.3	...	88.2	73.1	57.8
84	162	162	176	51.7	...	87.9	72.4	56.8
83	159	159	173	51.1	...	87.6	71.8	55.8
82	156	156	170	50.6	...	87.3	71.1	54.8
81	153	153	167	50.0	...	86.9	70.4	53.8
80	150	150	164	49.5	...	86.6	69.7	52.8
79	147	147	161	48.9	...	86.3	69.1	51.8
78	144	144	158	48.4	...	86.0	68.4	50.8
77	141	141	155	47.9	...	85.6	67.7	49.8
76	139	139	152	47.3	...	85.3	67.1	48.8
75	137	137	150	46.8	99.6	85.0	66.4	47.8
74	135	135	147	46.3	99.1	84.7	65.7	46.8
73	132	132	145	45.8	98.5	84.3	65.1	45.8
72	130	130	143	45.3	98.0	84.0	64.4	44.8
71	127	127	141	44.8	97.4	83.7	63.7	43.8
70	125	125	139	44.3	96.8	83.4	63.1	42.8
69	123	123	137	43.8	96.2	83.0	62.4	41.8
68	121	121	135	43.3	95.6	82.7	61.7	40.8
67	119	119	131	42.8	95.1	82.4	61.0	39.8
66	117	117	129	42.3	94.5	82.1	60.4	38.7
65	116	116	127	41.8	93.9	81.8	59.7	37.7
64	114	114	125	40.9	93.4	81.4	59.0	36.7
63	112	112	124	40.4	92.8	81.1	58.4	35.7
62	110	110	122	40.0	92.2	80.8	57.7	34.7
61	108	108	120	39.5	91.7	80.5	57.0	33.7
60	107	107	118	39.0	91.1	80.1	56.4	32.7
59	106	106	117	38.6	90.5	79.8	55.7	31.7
58	104	104	115	38.1	90.0	79.5	55.0	30.7
57	103	103	114	37.7	89.4	79.2	54.4	29.7
56	101	101	112	37.2	88.8	78.8	53.7	28.7
55	100	100	111	36.8	88.2	78.5	53.0	27.7
...	...	...	110	36.3	87.7	78.2	52.4	26.7
...	...	...	109	35.9	87.1	77.9	51.7	25.7
...	...	...	108	35.5	86.5	77.5	51.0	24.7
...	...	...	107	35.0	86.0	77.2	50.3	23.7
...	...	...	106	34.6	85.4	76.98	49.7	22.7
...	...	...	105	34.1	84.8	76.6	49.0	21.7
...	...	...	104	33.7	84.3	76.2	48.3	20.7
...	...	...	103	33.3	83.7	75.9	47.7	19.7
...	...	...	102	32.9	83.1	75.6	47.0	18.7
...	...	...	101	32.4	82.6	75.3	46.3	17.7
...	...	...	100	32.0	82.0	74.9	45.7	16.7
...	...	...	99	31.6	81.4	74.6	45.0	15.7
...	...	...	98	31.2	80.8	74.3	44.3	14.7
...	...	...	97	30.7	80.3	74.0	43.7	13.6
...	...	...	96	30.3	79.7	73.6	43.0	12.6
...	...	...	95	29.9	79.1	73.3	42.3	11.6
...	...	...	94	29.5	78.6	73.0	41.6	10.6
...	...	...	93	29.1	78.0	72.7	41.0	9.6
...	...	...	92	28.7	77.4	72.3	40.3	8.6
...	...	...	91	28.2	76.9	72.0	39.6	7.6
...	...	...	90	27.8	76.3	71.7	39.0	6.6
...	...	...	89	27.4	75.7	71.4	38.3	5.6
...	...	...	88	27.0	75.2	71.0	37.6	4.6
...	...	...	87	26.6	74.6	70.7	37.0	3.6
...	...	...	...	...	74.0	70.4	36.3	2.6

Operating Instructions & Parts Manual

Approximate Leeb (Type D) Hardness Conversion for Non-Austenitic Steels (Rockwell C Hardness Range)^A

Leeb Hardness, Type D Impact Device (HLD)	Rockwell C Hardness 150kgf (HRC)	Vickers Hardness (HV 10)	Brinell Hardness 10mm Steel Ball 3000kgf (HBS)
828	62	762	(721)
819	61	737	(699)
809	60	711	(675)
800	59	688	(654)
791	58	667	634
782	57	645	614
773	56	625	595
764	55	605	577
755	54	586	559
746	53	568	542
737	52	550	526
729	51	534	511
720	50	517	496
712	49	503	482
703	48	487	467
695	47	473	455
687	46	460	442
679	45	447	430
671	44	434	418
663	43	422	407
655	42	410	395
647	41	398	385
640	40	388	375
632	39	377	365
625	38	368	356
618	37	358	347
611	36	349	338
603	35	339	328
596	34	330	320
590	33	323	313
583	32	314	305
576	31	306	297
570	30	299	291
563	29	291	283
557	28	284	276
551	27	277	270
545	26	271	264
539	25	264	258
533	24	258	252
527	23	251	246
521	22	245	240
516	21	240	235
510	20	234	229

Operating Instructions & Parts Manual

Weight - Load - Indentor Chart

Scale Symbol	Indentor Type	Preliminary Force N (kgf)	Total Force N (kgf)	Typical Applications
A	Spheroconical Diamond	98.07 (10)	588.4 (60)	Cemented carbides, thin steel, and shallow case hardened steel
B	1/16" Carbide Ball	98.07 (10)	980.7 (100)	Copper alloys, soft steels, aluminum alloys, malleable iron, etc.
C	Spheroconical Diamond	98.07 (10)	1471 (150)	Steel, hard cast irons, pearlitic malleable iron, titanium, deep case hardened steel, other harder than HRB 100
D	Spheroconical Diamond	98.07 (10)	980.7 (100)	Thin steel and medium case hardened steel, and pearlitic malleable iron
E	1/8" Carbide Ball	98.07 (10)	980.7 (100)	Cast Iron, Aluminum and magnesium alloys, and bearing metals
F	1/16" Carbide Ball	98.07 (10)	588.4 (60)	Annealed copper alloys and thin soft sheet metals
G	1/16" Carbide Ball	98.07 (10)	1471 (150)	Malleable irons, copper-nickel-zinc and cupro-nickel alloys
H	1/8" Carbide Ball	98.07 (10)	588.4 (60)	Aluminum, zinc and lead
K	1/8" Carbide Ball	98.07 (10)	1471 (150)	Bearing Metals and other very soft or thin materials. Use smallest ball and heaviest load that doesn't give anvil effect.
L	¼" Carbide Ball	98.07 (10)	588.4 (60)	
M	¼" Carbide Ball	98.07 (10)	980.7 (100)	
P	¼" Carbide Ball	98.07 (10)	1471 (150)	
R	½" Carbide Ball	98.07 (10)	588.4 (60)	
S	½" Carbide ball	98.07 (10)	980.7 (100)	
V	½" Carbide ball	98.07 (10)	1471 (150)	
15N	Spheroconical Diamond	29.42 (3)	147.1 (15)		Similar to A, C and D scales but for thinner gage material.
30N	Spheroconical Diamond	29.42 (3)	294.2 (30)	
45N	Spheroconical Diamond	29.42 (3)	441.3 (45)	
15T	1/16" Carbide Ball	29.42 (3)	147.1 (15)	Similar to B, F and G scales but for thinner gage material.
30T	1/16" Carbide Ball	29.42 (3)	294.2 (30)	
45T	1/16" Carbide Ball	29.42 (3)	441.3 (45)	
15W	1/8" Carbide Ball	29.42 (3)	147.1 (15)	Very Soft Material
30W	1/8" Carbide Ball	29.42 (3)	294.2 (30)	
45W	1/8" Carbide Ball	29.42 (3)	441.3 (45)	
15X	¼" Carbide Ball	29.42 (3)	147.1 (15)	
30X	¼" Carbide Ball	29.42 (3)	294.2 (30)	
45X	¼" Carbide Ball	29.42 (3)	441.3 (45)	
15Y	½" Carbide Ball	29.42 (3)	147.1 (15)	
30Y	½" Carbide Ball	29.42 (3)	294.2 (30)	
45Y	½" Carbide Ball	29.42 (3)	441.3 (45)	

Operating Instructions & Parts Manual

Round Correction Factors

Corrections to be added to test results in the following scales for various diameter parts.

Corrections to be added to Rockwell C, A and D values

Diameter of Convex Cylindrical Surfaces

Hardness Reading	¼" 6.4mm	3/8" 10mm	½" 13mm	5/8" 16mm	¾" 19mm	7/8" 22mm	1" 25mm	1-1/4" 32mm	1-1/2" 38mm
20	6.0	4.5	3.5	2.5	2.0	1.5	1.5	1.0	1.0
25	5.5	4.0	3.0	2.5	2.0	1.5	1.0	1.0	1.0
30	5.0	3.5	2.5	2.0	1.5	1.5	1.0	1.0	0.5
35	4.0	3.0	2.0	1.5	1.5	1.0	1.0	0.5	0.5
40	3.5	2.5	2.0	1.5	1.0	1.0	1.0	0.5	0.5
45	3.0	2.0	1.5	1.0	1.0	1.0	0.5	0.5	0.5
50	2.5	2.0	1.5	1.0	1.0	0.5	0.5	0.5	0.5
55	2.0	1.5	1.0	1.0	0.5	0.5	0.5	0.5	0
60	1.5	1.0	1.0	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
70	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0	0
75	1.0	0.5	0.5	0.5	0.5	0.5	0	0	0
80	0.5	0.5	0.5	0.5	0.5	0	0	0	0
85	0.5	0.5	0.5	0	0	0	0	0	0
90	0.5	0	0	0	0	0	0	0	0

Corrections to be added to Rockwell B, F and G values

Diameter of Convex Cylindrical Surfaces

Hardness Reading	¼" 6.4mm	3/8" 10mm	½" 13mm	5/8" 16mm	¾" 19mm	7/8" 22mm	1" 25mm
0	12.5	8.5	6.5	5.5	4.5	3.5	3.0
10	12.0	8.0	6.0	5.0	4.0	3.5	3.0
20	11.0	7.5	5.5	4.5	4.0	3.5	3.0
30	10.0	6.5	5.0	4.5	3.5	3.0	2.5
40	9.0	6.0	4.5	4.0	3.0	2.5	2.5
50	8.0	5.5	4.0	3.5	3.0	2.5	2.0
60	7.0	5.0	3.5	3.0	2.5	2.0	2.0
70	6.0	4.0	3.0	2.5	2.0	2.0	1.5
80	5.0	3.5	2.5	2.0	1.5	1.5	1.5
90	4.0	3.0	2.0	1.5	1.5	1.5	1.0
100	3.5	2.5	1.5	1.5	1.0	1.0	0.5

Minimum Thickness Requirements

Minimum allowable thickness for a corresponding hardness in the respective scales

Minimum Thickness Inch	Minimum Thickness mm	Rockwell C	Rockwell A	Rockwell B	Superficial 15N	Superficial 30N	Superficial 45N	Superficial 15T	Superficial 30T	Superficial 45T
0.006	0.15	...	...	...	...	...	...	...	...	...
0.008	0.20	...	...	...	92	...	...	...	...	...
0.010	0.25	...	...	...	90	...	...	91	...	...
0.012	0.30	...	...	...	88	82	77	86	...	...
0.014	0.36	...	...	...	83	78.5	74	81	80	...
0.016	0.41	...	86	...	76	74	72	75	72	71
0.018	0.46	...	84	...	68	66	68	68	64	62
0.020	0.51	...	82	...	...	57	63	...	55	53
0.022	0.56	69	79	...	...	47	58	...	45	43
0.024	0.61	67	76	94	...	...	51	...	34	31
0.026	0.66	65	71	87	...	...	37	...	...	18
0.028	0.71	62	67	80	...	...	20	...	...	4
0.030	0.76	57	60	71
0.032	0.81	52	...	62
0.034	0.86	45	...	52
0.036	0.91	37	...	40
0.038	0.96	28	...	28
0.040	1.02	20

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