Tall Frame Hardness Tester

Model No 900-332

Operation Manual

Model No. 900-332

Model No. 900-332D

MODEL NO. 900-332D

To reference digital indicator functions and usage, please see 900331-9500 Operation Manual at the back of this manual

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

Phase II Hardness Testers accurately measure hardness of materials in Rockwell hardness A, B, and C scales. Heat-treated steels are tested using a 120° diamond indentor in the C-scale (HRC 20-70). Soft materials are tested using a 1/16" steel ball indentor in the B-scale (HRB 25-100). Very hard materials are tested using a 120° diamond indentor in the A-scale (HRA 20-88). Tester features a weight adjustment handle for quick and easy adjustments between different scales. Release and reset levers are provided for quick and accurate testing. Hardness Tester includes standard, large and V-shaped anvils for holding small, large and round or curved materials. Storage box, 5 test blocks, 120° diamond indentor and 1/16" carbide ball indentor.

Unpacking

Loose Parts Storage Box:

A. Large Anvil
B. Small Diameter Anvil
C. V-shaped Anvil
D. Five Test Blocks
1. One each, HRA 70-85
2. One each, HRB 75-95
3. One each, HRC 25-35
4. One each, HRC 40-50
5. One each, HRC 55-65

E. 120° Diamond Indentor
F. 1/16" carbide Ball indentor
G. Storage Box

Remove 4-nuts from side panels of crate.
Carefully lift crate up from base. Leave the tester bolted to crate bottom.
Remove storage box from crate.

Be sure tester is level both front/back and left/right to 0.002 in/in.

IMPORTANT!

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

Basic Set Up Information:

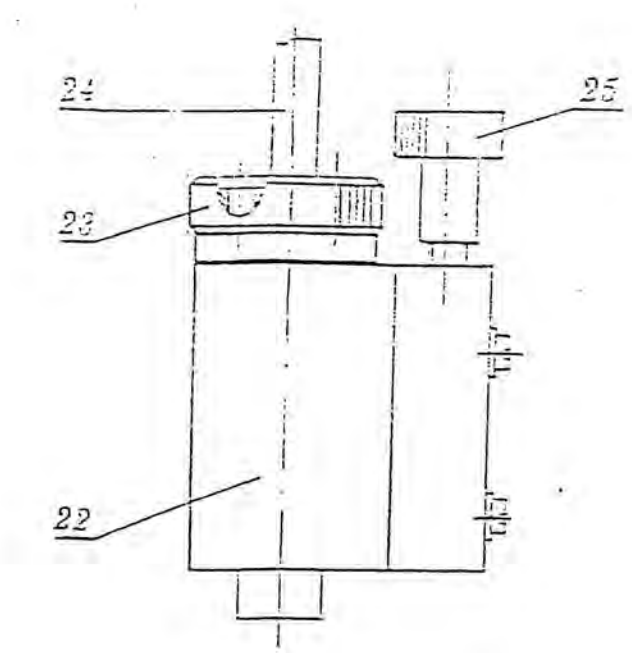
1) Loosen the 4 nuts on the bottom of the crate. Lift the crate off the platform being careful not to scratch the side of the hardness tester
2) Remove the tool kit from the platform
3) Remove the plastic dust cover
4) Remove the string holding the handles and top cover of the machine
5) Lift the top cover straight up and off the machine
6) Remove the rubber band holding the indicator lever and discard it.
7) Remove the back cover of the machine by removing the 2 phillips head screws from the top and bottom of this cover
8) Carefully remove the string that is holding the weight bar to the loading bar
9) Remove the weight bar from the loading arm by lifting the hook of the bar from the loop on the arm.
10) Remove the 2-nuts from the bottom of the bar.
11) Open the test kit and remove the 3 weights. Clean oil/grease from these weights.
12) Take the round weight marked "A" or "1" and slide it up the bottom of the weight bar and proceed to place both nuts back on the threaded part of the weight bar effectively holding the round weight in place.
13) Carefully place the weight bar back in the loop of the loading arm with the hook facing the front of the machine.
14) Place weight "B" or "2" and place on the middle section of the weight bar keeping the flat side of the weight facing the rear of the machine. Place weight "C" or "3"on top of the weight bar keeping the flat part towards the rear of the machine.
15) Install the rear cover with the 2-screws.
16) Install the top cover by placing it straight down while lining up the pins on each side.
17) Lower the rotary handle and remove the black plastic shaft protector. Keep this for future safety use.
18) Choose the applicable work table (anvil) and install on the machine.
19) Remove the Diamond penetrator from the tool kit and install in the penetrator shaft making sure the flat lines up with the set screw on this shaft. Be sure that the diamond sits flush inside this shaft. See "Seating Diamond" section in this manual prior to testing. Do not overtighten this set screw!
20) Remove all C-scale test blocks from the tool kit and clean off all grease or oil from both sides.
21) Set the weight selector know to 1471 (150kg).
22) Place one of these test blocks on the anvil and rotate until the block just makes contact with the diamond. Begin to turn the rotary handle making sure the large needle on the dial goes around 3 times. On the 3rd time you must be sure that you stop when the large needle lands on the "0" at top dead center.
23) Push the black handle towards the rear of the machine. At this time the tester is putting the load on the test block and you will see that the large needle will slowly move counter-clockwise. Once the needle stops moving you need to pull the black handle back towards the front of the machine. At this time you take the reading off the black numbers off the dial. Repeat this a minimum of 5 times to achieve an accurate reading.

Optional Cabinet/Support Stand

Example of Weight installation

Adding Oil to the Handle Buffer

If when moving the Load/Unload handle and you feel it make fast hard contact or hear a suction noise then its time to check the oil buffer.
On the left side of the machine (when standing in front of it) there is a small metal access plate held on by 2 small screws. Remove the screws and plate to expose the valve and reservoir.
Push the Load/Unload handle towards the back of the machine. Remove the screw #25 and carefully add high grade hydraulic oil into the hole.
Begin pulling/pushing the Load/Unload handle back and forth until any suction noise has disappeared.
Replace screw #25. Replace access plate.



Rockwell B Indentor
1/16" Carbide Ball

Rockwell C Indentor
Diamond

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 indentor 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.)

Installation
Hardness Tester must be installed in a dust and vibration free environment. Mount tester to a support bench or table for a load of at least 500 lbs.
1. Position tester on support surface as desired, mark location of the 4 mounting holes in the corners of the frame base and for the elevation screw on the support surface.
2. Drill 10mm (7/16") diameter holes at the 4 mounting hole locations. Drill a 2" diameter hole for the elevation screw.

Caution: The hardness tester will not open to its full capacity unless the elevation screw is allowed to pass through a hole on the support surface.

3. Bolt tester to support surface securely using the 4 each hex head bolts (Fig.2, Ref. A), use longer 10-1.5mm bolts if required.

Be sure tester is level both front/back and left/right to 0.002 in/in.

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

Seating Your Diamond:

Caution: To ensure accuracy, mount the indentor by sliding it in the holder as far as possible and then securing the indentor 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.

1. 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.
2. 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.

Operation:

Determine the proper indentor, scale and weight for the material hardness to be tested (see Figure 3). Mount the required indentor in the indentor holder using the set screw (Fig. 6, Ref. Nos. 27 and 28) on the side of the holder.

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 indentor. Be sure to position specimen so the indentor 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 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.

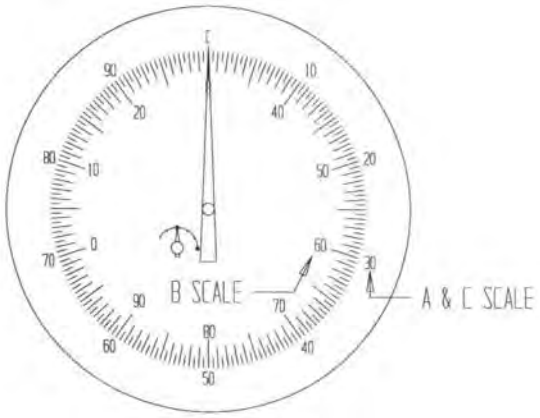


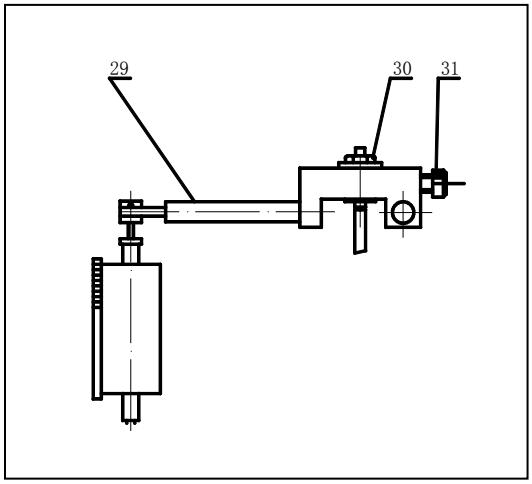
Figure 4 - Dial Indicator

Maintenance

1. Be sure elevation screw and threaded collar are clean and lubricated. Lubricate with general purpose light duty oil.
2. Keep top of leadscrew, collar and anvils clean and free of grease, oil, dirt, burrs, etc.
3. Use the test blocks periodically to check tester accuracy. Use an oil sharpening stone to remove the burrs from the test blocks.

Fine adjustment for 900-332

(for 900-332D, please refer to indicator instructions at the back of this manual)



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 900-332 as this machine is extremely sensitive to any movement.

Remove the top cover off the 900-332.

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

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

Carefully hold the #30 set screw in place with a thin blade regular screwdriver. While holding this screw steady, carefully loosen the set screw hex nut.

Take a minimum of 3 tests on your test block to make sure the machine is reading correctly. If readings are low, you will need to back off on the set screw a little. The opposite direction if readings are high. Take 3 more tests on each block to verify your readings are within the allowable tolerance.

Troubleshooting Chart

Symptom	Possible cause(s)	Corrective Action
Incorrect hardness measurement	1. Contaminants effecting measurement 2. Elevation screw cover is interfering with specimen, anvil or elevation screw. 3. Indentor is damaged. 4. Dash pot is low on oil.	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 well below the anvil. 3. Inspect indentor for damage, replace diamond indentor if chipped or broken, replace 1/16" steel 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.	1. Burrs on bottom of test block. 2. Air trapped under test block.	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	1. Dash pot is low on oil.	1. Refill dash pot See Maintenance, above.

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

		Brinell Hardness Number [C]			Rockwell		Superficial Rockwell Number			
Rockwell C 150kgf (HRC)	Vickers (HV)	10-mm Standard ball 3000kgf (HBS)	10-mm Carbide ball 3000kgf (HBW)	Knoop 500-gf and Over (HK)	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)	Scleroscope Hardness[B]
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

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

				Rockwell		Superficial Rockwell Number		
Rockwell B 100kgf (HRB)	Vickers (HV)	10-mm Standard ball 3000kgf (HBS)	Knoop 500-gf and Over (HK)	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

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

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)	

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	...	...	...	...	...	...	...	...

Digital Hardness Indicator Upgrade

For Rockwell Hardness Testers

The 9500 series digital hardness indicators are an accurate yet affordable option to replace the dial on your analog hardness tester. The 9500 series hardness indicator gives you the complete functionality of a true digital Rockwell hardness tester with popular features such as statistics, memory, conversions to Brinell hardness scale or Vickers hardness scale, limit setting and more.

Specifications: *For Digital Hardness Indicator*

Model No.	900331-9500/900330-9500	900345-9500
Scales-Rockwell	A, B, C, D, E, F, G, H, K	15N, 30N, 45N, 15T, 30T, 45T
Resolution	0.1HR	0.1HR
Display	128x64 Matrix LCD w/Backlight	128x64 Matrix LCD w/Backlight
Memory	1000 Readings	1000 Readings
Conversions	Brinell, Vickers	Brinell, Vickers
Power	Ni-Mh Battery w/Charger	Ni-Mh Battery w/Charger
Dimensions	114 x 37mm Dia. Mounting: 108x16mm Dia.	114 x 37mm Dia. Mounting: 108x16mm Dia.
Weight	14.8oz.	14.8oz.

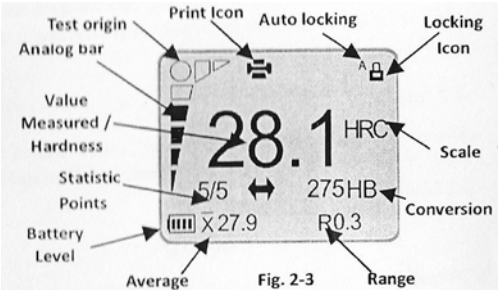


Fig. 2-3

MODEL NO.	DESCRIPTION	COMPATABILITY
Model No. 900330-9500	Indicator for 3R type Hardness Testers	Fits Phase II 900-330, 900-332 and HR150
Model No. 900331-9500	Indicator for Rockwell Hardness Testers	Fits Phase II 900-331, Starrett 3814, SPI 15-817-0
Model No. 900345-9500	Indicator for Superficial Hardness Tester	Fits Phase II 900-345

Digital Indicator

Series 9500 Digital Indicators

IMPORTANT!

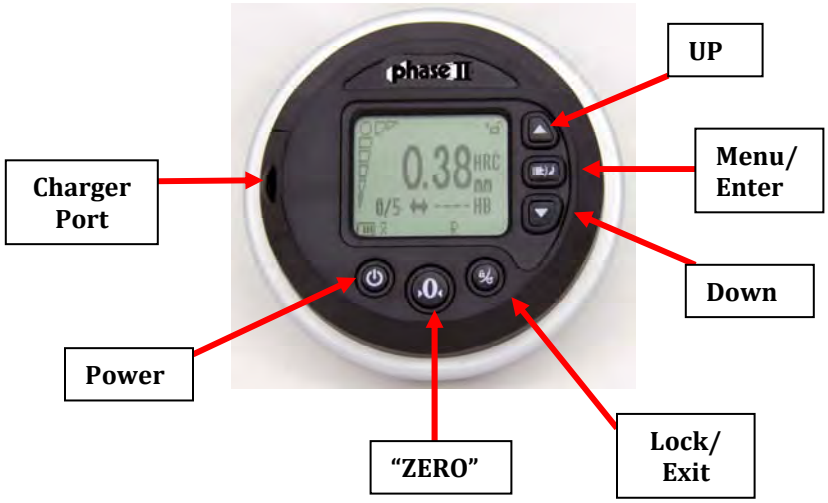
Follow the instructions for setting up the indicator BEFORE performing any tests. Once the indicator is set up you can begin taking tests as shown in the manual on Page 10.

Features:

The 9500 series digital indicators are an accurate yet affordable option to replace the dial on your analog hardness tester. The 9500 series indicator gives you the complete functionality of a true digital machine with popular features such as statistics, memory, conversions to Brinell or Vickers, limit setting and more.

Each indicator will come complete with Data Cable and Charger.

External Structure:



LCD Display:

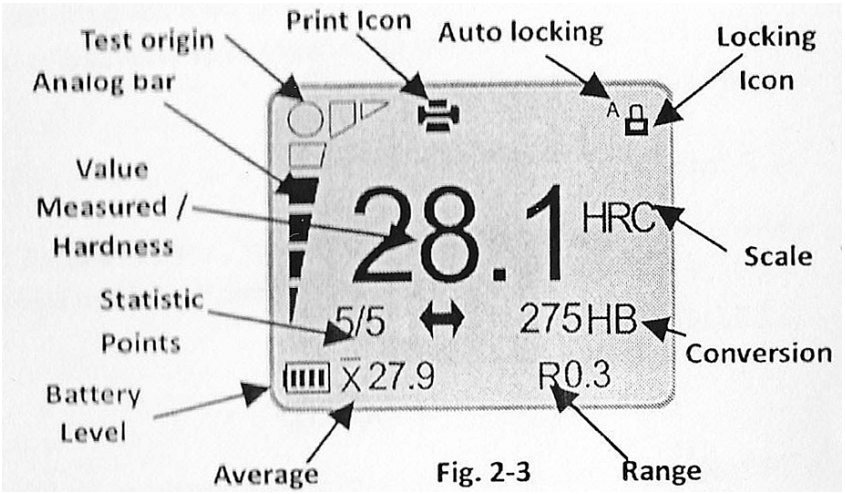


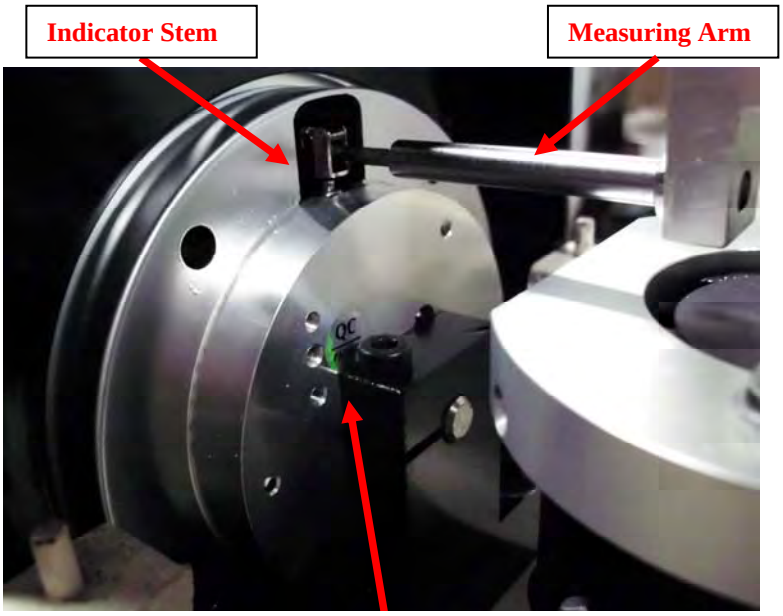
Fig. 2-3

Specifications:

Model No.	900331-9500/900330-9500	900345-9500
Scales-Rockwell	A, B, C, D, E, F, G, H, K	15N, 30N, 45N, 15T, 30T, 45T
Resolution	0.1HR	0.1HR
Display	128x64 Matrix LCD w/Backlight	128x64 Matrix LCD w/Backlight
Memory	1000 Readings	1000 Readings
Conversions	Brinell, Vickers	Brinell, Vickers
Power Auto-Power Off	Ni-Mh Battery w/Charger	Ni-Mh Battery w/Charger
Dimensions	114 x 37mm Dia. Mounting: 108x16mm Dia.	114 x 37mm Dia. Mounting: 108x16mm Dia.
Weight	14.8oz.	14.8oz.

Installation:

1) Be sure that indicator has sufficient charge. If the battery symbol is empty you should charge the indicator for approx. 1.5 hours prior to use.
2) Press the Power button to turn on. The indicator will perform a self check and stop at the main testing screen. **Power OFF.**
3) Make sure your hardness tester is in the **UNLOADED** position.
4) Remove the indicator from your hardness tester.
5) Place the digital indicator in place as shown in the picture below. Gently lift the indicator stem to allow the measuring arm to go into the lifting hole of the stem. Gently lift the measuring arm to be sure the up and down movement is smooth. Tighten screws once in correct position.

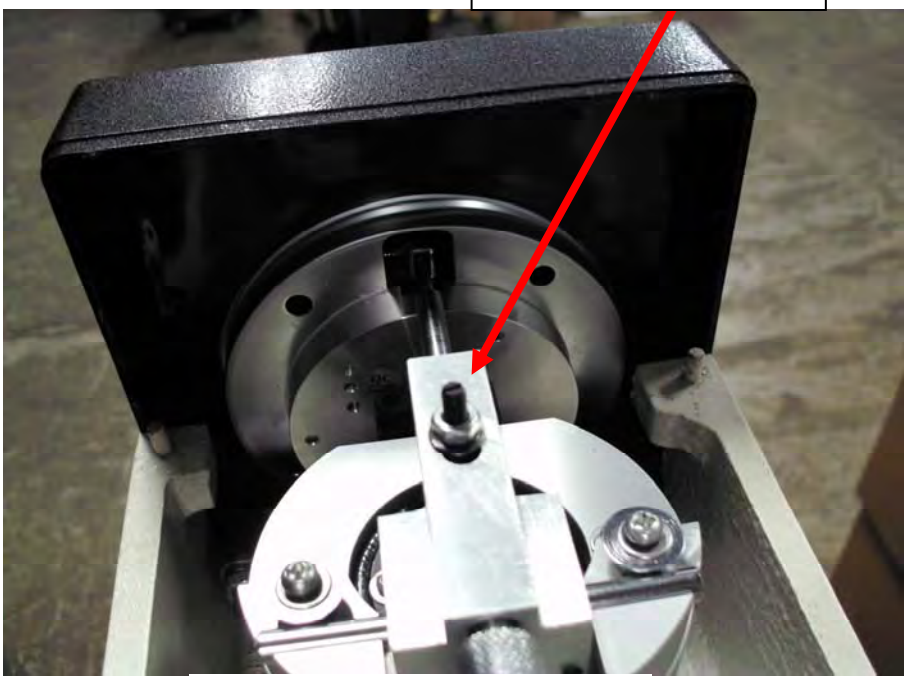


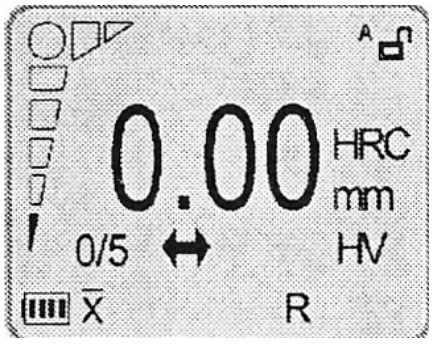
Lockdown Screw

Operation:

1) Power the indicator on.
2) There will be a value shown on the display. This value must be set to ZERO by turning the fine adjustment on your hardness tester as shown in the picture below.

Fine Adjustment Set Screw





Example of display at Zero point.

Setting Parameters:

1) ***Hardness Scale***: Press the Menu/Enter button. Make sure Measurement is highlighted. Press the Menu/Enter button again and SCALE should be highlighted. Press the Menu/Enter button to open up the list of hardness scales. Use the Arrow buttons to scroll through the choices and highlight the scale that you want the indicator to read in.
If you are not sure about your selection, please reference the chart below:

Model	Scale	Indenter	Test Force(N)	
			F_0	F
9500	HRC	Diamond	98.07	1471
	HRA			588
	HRD			980
	HRB	1/16"		980
	HRF			588
	HRG			1471
	HRE			980
	HRH			588
	HRK			1471
9545	HR15N	Diamond	29.42	147.1
	HR30N			264.8
	HR45N			411.9
	HR15T	1/16		147.1
	HR30T			264.8
	HR45T			411.9

Auto Locking:
This feature will automatically hold the hardness value the moment the reading is stable. On softer metals the penetrator may continue to indent the material which may affect the reading. The lock feature will prevent the value from changing once stabilized even though the penetrator may still be moving.

Auto Locking con't:
If you don't want this feature then turn it off by changing in the menu. Follow instructions below:
1) Press the Menu/Enter button. Make sure Measurement is highlighted. Press the Menu/Enter button again and scroll down to Auto Locking. Auto-Locking should be highlighted. Press the Menu/Enter button to open up the choices. Use the Arrow buttons to scroll through the choices and highlight OFF if you don't want to use this feature.

Auto Zero:
The 9500 series indicators allow you to select either Auto Zero or you can manually set zero. Auto zero will bring the value back to zero automatically after the load is removed from the previous test. When the indicator is set to Manual Zero you may need to pres the Zero button on the indicator to be sure its set to Zero before the next test is performed. Follow instructions below:
1) Press the Menu/Enter button. Make sure Measurement is highlighted. Press the Menu/Enter button again and scroll down to Auto Zero . Highlight Auto Zero. Press the Menu/Enter button to open up the choices. Use the Arrow buttons to scroll through the choices and highlight OFF if you don't want to use this feature.

Statistics:
This feature allows you to set the number of tests to be averaged. The results will automatically be shown on the display after each test. Once the set number of tests have been obtained, the average and repeatability value will be shown on the display.

Statistics, con't:
1) Press the Menu/Enter button. Make sure Measurement is highlighted. Press the Menu/Enter button again and scroll down to Statis Points. Statis Points should be highlighted. Press the Menu/Enter button to open up the choices. Use the Arrow buttons to scroll through the values of **2 Thru 9**. According to ASTM, you should take a minimum of 5 tests and obtain your average for the true hardness value of your part. If you don't want to use this feature then scroll down past "2" and the display will show "OFF".

Conversions:
The 9500 series indicators will display conversions to either Brinell or Vickers scale once this feature is turned on.

1) Press the Menu/Enter button. Make sure Measurement is highlighted. Press the Menu/Enter button again and scroll down to Conversions. Conversions should be highlighted. Press the Menu/Enter button to open up the choices. Use the Arrow buttons to scroll through the choices and highlight OFF if you don't want this feature.

Upper/Lower Limit Setting:
The 9500 series indicators have an Upper/Lower limit setting with alarm. Once set, the indicator will alert you to a hardness value that is outside of your preset limits.
See instructions for limit setting below:

1) Press the Menu/Enter button. Make sure Measurement is highlighted. Press the Menu/Enter button again and scroll down to Limit Alarm. Limit Alarm should be highlighted. Press the Menu/Enter button to open up the choices. Use the Arrow buttons to scroll through the choices and highlight OFF if you don't want this feature.
Highlight Enter and press the Menu/Enter button to set your limits.
Use the Up and Down arrows to change the values to match your desired limit settings.
Once obtained, press the Menu/Enter button to save. Scroll up to ON and highlight that.
Press the Menu/Enter button to save and return to the main test screen.

Memory Functions:
The 9500 series indicators can store up to 999 hardness values and can be viewed at your convenience by accessing the memory. Access the memory setting by following below:

1) Press the Menu/Enter button. Scroll down to Memory and highlight it. Press the Menu/Enter button again and you will see the three choices available for this indicator.
Browse All: This allows you to view all of the values stored in the memory.
Browse Select: This allows you to select the values in memory by a particular hardness scale. In other words, if you only want to see the Rockwell C scale values, you would select HRC in this menu.
Print: This is not an option on the 9500 series indicators.

System Settings:
1) Key Tone: This feature can be turned on or off in the menu.

2) Backlight: This feature can be turned on or off in the menu.

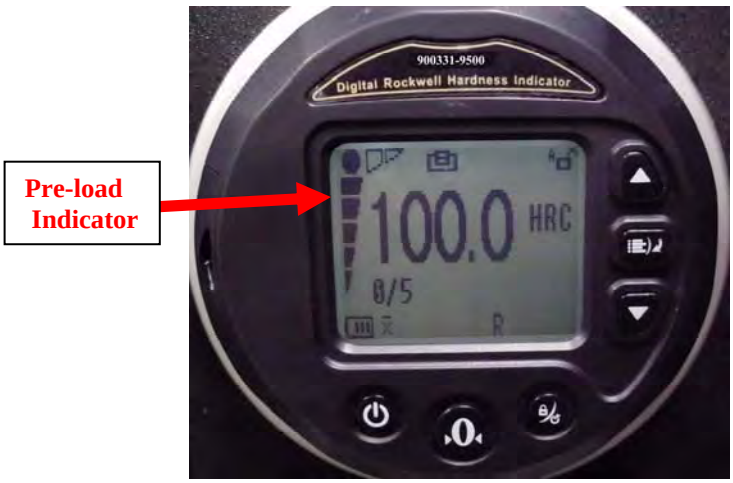
3) Language: This indicator can be set to English or Chinese in the menu.
4) Date/Time Setting: You can set the date and time in the menu.

TAKING A TEST:

Assuming the indicator has been set up correctly and the Auto Zero is turned on, you can begin taking a test as you normally would with your hardness tester.

A) Make sure you have the correct penetrator installed and the weight selection set for your hardness scale.
Reference the Weight Load Indentor Chart
1) Be sure that your anvil is clean of oil, dust, rust, etc.
2) Place a good quality calibration test block on the anvil and begin rotating the test block up until you just make contact with the penetrator.
3) Continue rotating up and immediately take not of the Analog bar on the left side of the indicator. This will rise as the block continues into the penetrator. The indicator will soon "Beep" alerting you that its almost at the top. Once the pre-load is set the indicator will show either 2.80mm or 3.20mm (depending upon the scale set) and immediately change over to 100.0HRC. The analog bar will be solid right up to the Circle.

See picture below:



4) Once you see the display as shown above you must now apply the major load on the hardness tester. You will now see the values on the display change in a descending order.
5) Once the value on the display is stable (should be between 5-8 seconds) you must now Unload the machine and you can take your reading directly off the indicator display.

IMPORTANT!

Your first test should always be discarded. Begin testing for average on the second test. ASTM suggests that you take 5 tests and obtain your average. That average is the value to be used as the true hardness reading.

CALIBRATION:

The 9500 series indicators have a built-in calibration feature which should only be used for fine adjustments. If the obtained results on your calibration blocks are well outside of tolerance, you should adjust and repair the base machine before you adjust the indicator.

1) Press the Menu/Enter button. Scroll down to System and highlight it. Press the Menu/Enter button again and you must scroll down to Correction.
2) Press the menu/Enter button and you will see three choices:
a) Off
b) On
c) Enter

If you don't want to change calibration then leave it in the off position and return to the main test screen.

If you highlight ON, this will activate the Auto-Calibration feature which will allow the indicator to automatically correct the measured value when the "Lock" feature is on.

If you highlight Enter, this will allow you to set the calibration by manually entering in the value shown on the test block.
Example: If the value shown on your test block is HRC 25.8 then you would enter that value while in the enter screen.
Now take a test on that same test block as normal.

Once the result has been obtained Press the Menu/Enter button and then choose Save and then save the calibration. If you choose Exit then the calibration will not be saved.

Maintenance:

The 9500 series indicators are highly sensitive and accurate instruments and should be treated as such.
These should remain in a temperature controlled environment with the least amount of shock or vibration as possible.
Cleaning:
Use soft damp cloth only. Do not use harsh chemicals as this will deteriorate the finish of the indicator.

Technical Support and Repair:
Contact Phase II at (201) 962-7373

Effective: 12/1/2011

Warranty /Return Policy

Warranty Policy:

All portable and stationary material testing instruments manufactured for/by Phase II shall be free from defects in material and workmanship for a period of 1to 5 full years(depending upon model)from date of purchase. Parts found to be defective shall be replaced or repaired at Phase II's sole discretion. Products found by Phase II to be misused, abused or neglected are not covered under this warranty. Parts not covered by this warranty are normal wear and consumable items such as (but not limited to) impact balls, impact bodies, diamond indentors, carbide ball indentors, impact springs, cables and connectors, batteries, diamond stylus, contact probes, etc.

Consumable(wearable) items such as cables and probes have a 90 day warranty from date of purchase.

This warranty is exclusive and in lieu of all other warranties whether written, oral or implied, including any implied warranties or merchantability or fitness for a particular purpose. In no event shall Phase II be liable for any incidental, special or consequential damages of any nature.

Return Policy:

All Phase II products must have authorization prior to return.

If product is not acceptable for any reason including application issues and demonstrations, authorization for return must be obtained within 10 days of receipt of product. Unit must be in same new condition it was received. Failure to do so will result in an automatic 15% restocking fee.

Returns after 30 days will not be accepted.