INDENTRON®

NI-300 SERIES

ROCKWELL HARDNESS TESTING SYSTEM

OPERATION MANUAL

3/00

MODELS NI300C, NI300RD, NI300SRD

NEWAGE
Testing Instruments, Inc.

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7. Handwheel
8. Leveling Feet
9. Load Range Lever (Regular or Superficial)
10. Power Switch/Connector
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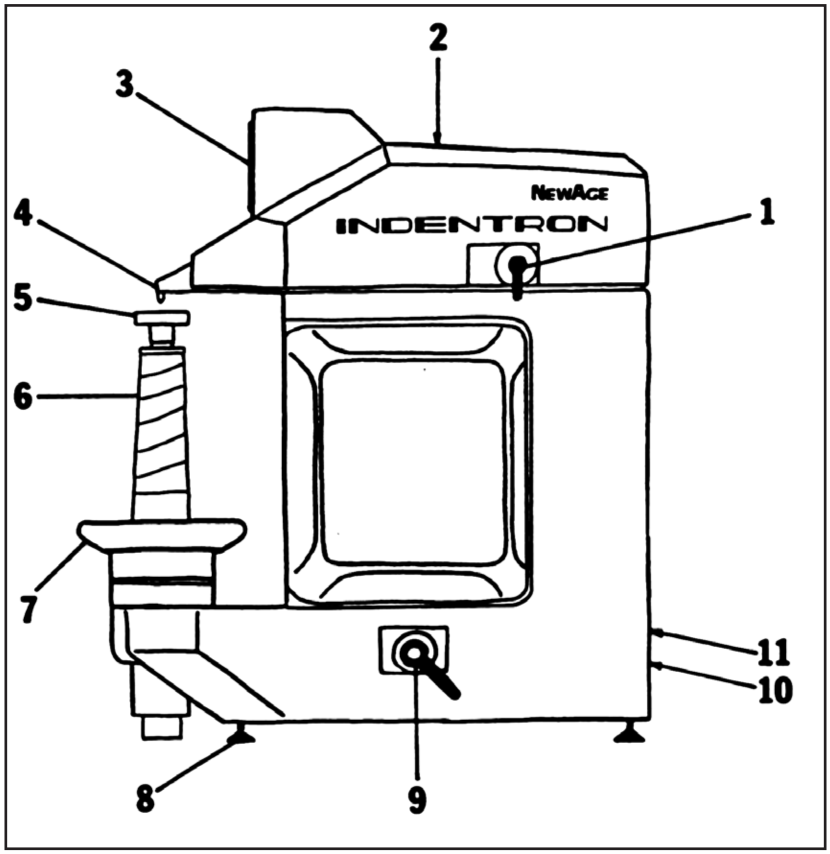
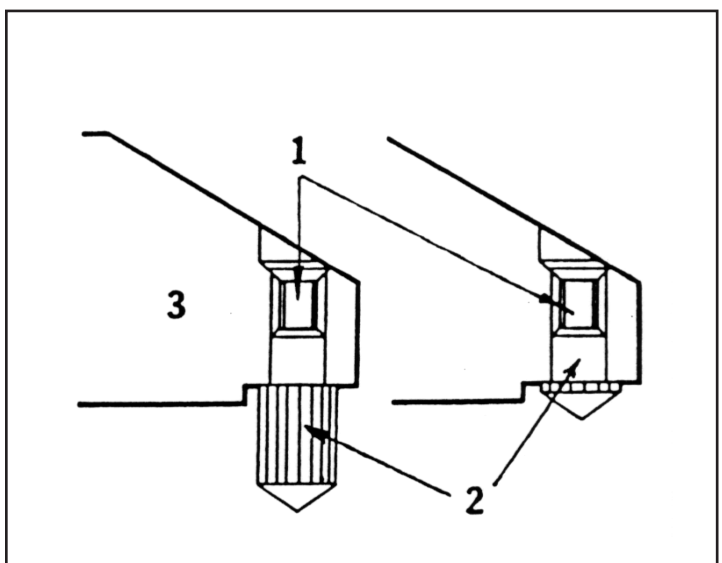


INDENTER AREA
1. Allen Screw {4mm)
2. Indenter
3. Indenter Holder (Nose}



Regular Indenter Short Indenter

1.2 UNPACKING INSTRUCTIONS

After you have uncrated the unit, the machine can now be lifted from the skid or crate. DO NOT HIT THE INDENTER NOSE!

NOTE: If at any time the machine is to be moved, always remove the indenter and the weights and sandwich the rubber strip between the indenter nose and ton of the anvil.

1.3 INSTALLATION INSTRUCTIONS

1.3.1 Preliminary Installation

Mount on firm bench or table in a clean area, free from vibration.

The bench height should be between 25" for seated and 32" for standing operation.

Position the machine so that the elevating screw is extended over the edge of the workbench.

Remove the top canopy screw and lift off canopy, making sure to avoid damaging displays.

Turn handwheel counterclockwise and remove the rubber packing from between the anvil and the indenter nose.

Remove all elastic bands and packing material from inside machine.

ELECTRICITY: Single phase AC, 115V, 60 Hz, 5 amp

LEVELING Lower the elevating screw with the handwheel about 3" and fit the 70 mm dia. flat anvil into the hole on the top of the elevating screw.

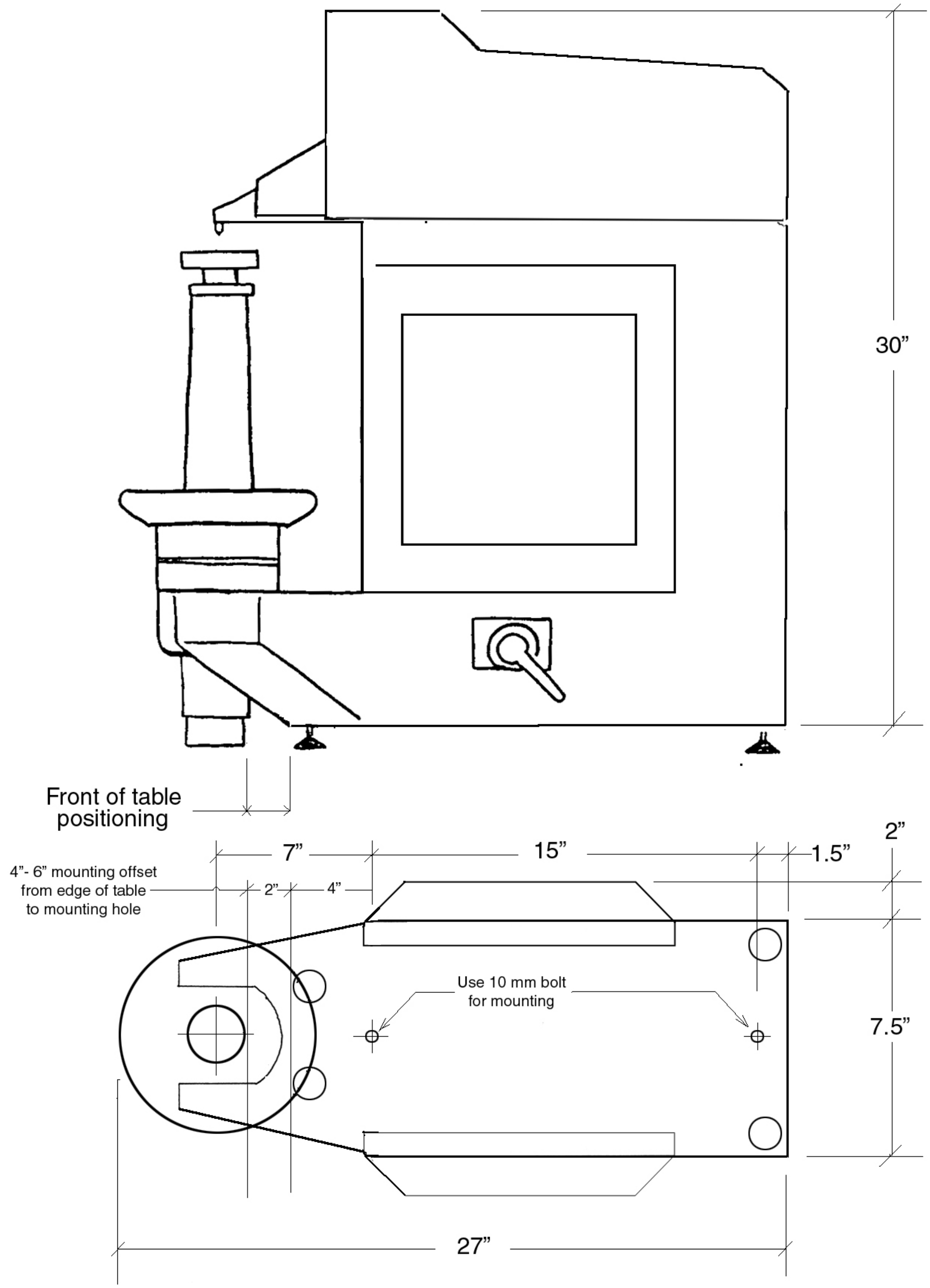
With a bubble level on the anvil adjust the level with the leveling feet, making certain all levelling feet make firm contact with the support table to prevent rocking.

ATTACHING THE PRINTER CABLE

Printer cables are supplied with testers that have been sold with printers. The cable connects to the back of the tester.

INDENTRON
MOUNTING AND ENVELOPE DIMENSIONS

NOTE: Dimensions are approximate except for mounting hole spread
Not drawn to scale



1.3.2 Assembling Proportional Weights

There are four weight assemblies for Regular and Combination Rockwell, three for Superficial Models. For identification they are numbered 1 to 4 in 1/16" high letters on the top surface of each weight. (Make certain serial numbers of weights agree with serial number of machine - located on inside of one of the access doors and on top right hand side of machine frame casting.)

The weight assemblies are positioned in numerical order, No. 1 at the front of the machine.

Turn the load change knob counterclockwise (i.e. to the 15/60 kg position).

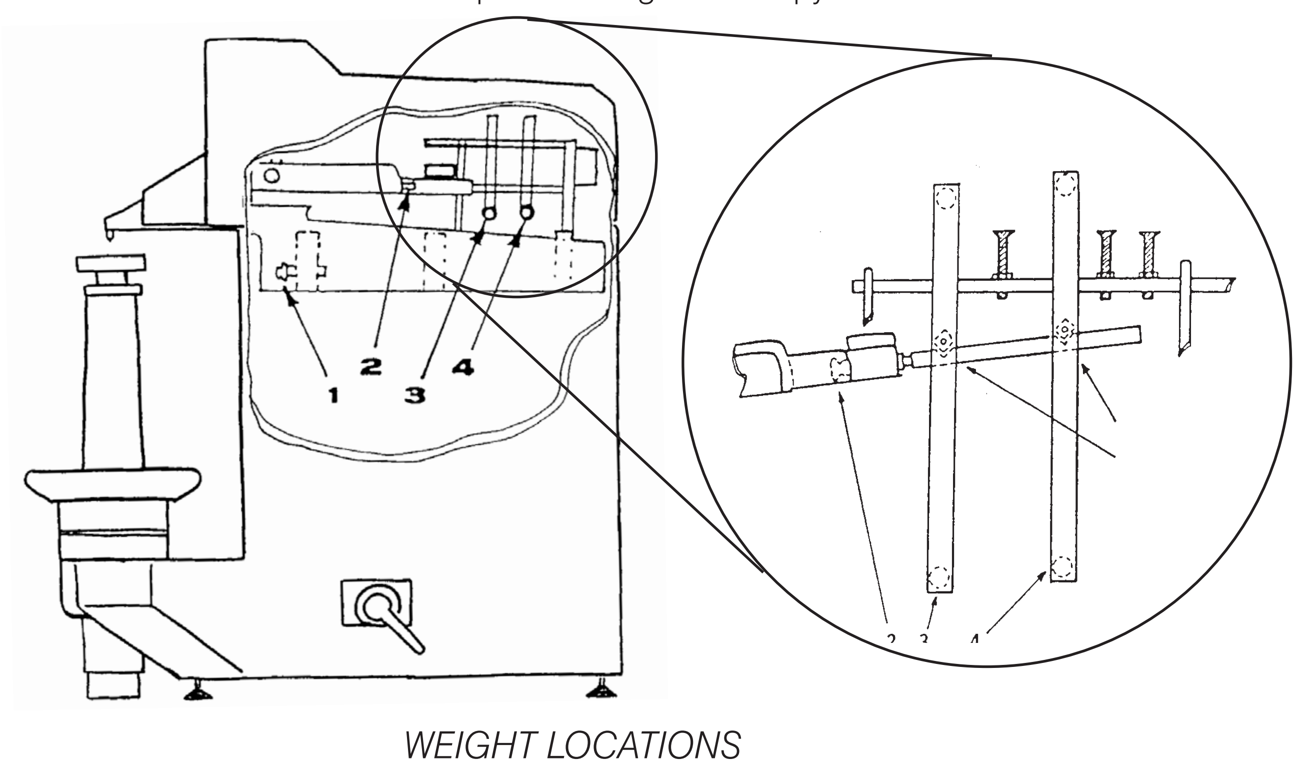
Fit weight #1 first (Only used for Regular or Combination units). Lift the weight and position on the lower of the two levers, at the front, with the weight ring's knife edge set in the turned groove of the weight hanger. (See drawing for weight positions.)

Fit weight No. 4 next for convenience, then 3 and finally No. 2. Weight No. 2 fits as weight No. 1 but to a similar hanger on the top lever.

Weights 3 and 4 hook between vibration-proof nuts in the weight hangers on the top lever. Ensure that the square knives in the weight hangers are properly located in the vee grooves.

Re-fit the canopy again with the load change knob in the 15/60 kg position.

Centralize the canopy about the indenter nose and finally pull the canopy forward to nsure that it clears the main bottom lever. Replace and tighten canopy screw.



WEIGHT LOCATIONS

2 TESTER SET UP

2.1 Setting the Scale and Time-at-Load

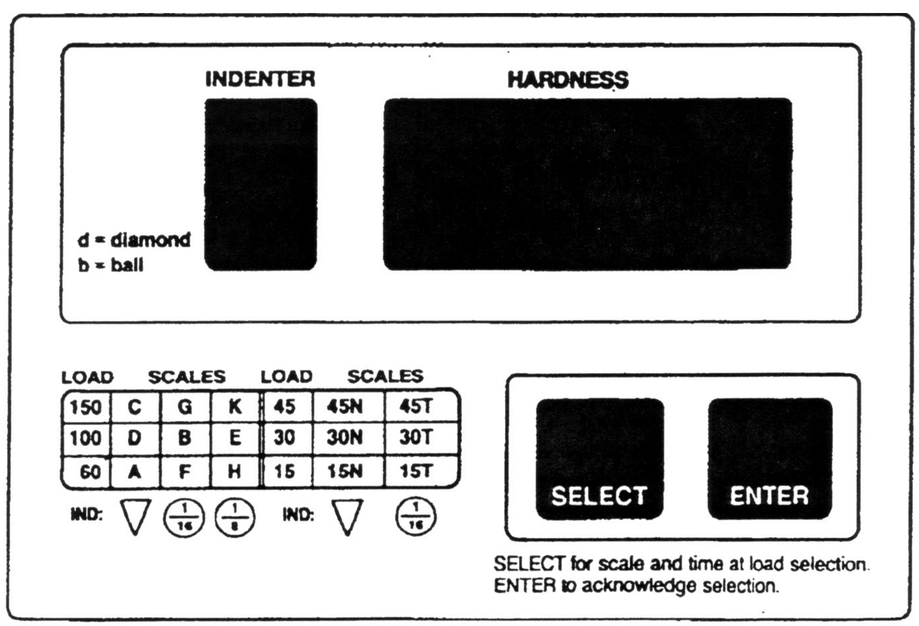
1. Press the SELECT key, and the display will switch to show the possible range selections for the particular model being used: diamond, ball, or superficial. (The indenter must not be touching the specimen.) The operator's selection will depend on the desired scale. (Refer to the chart on page 13/14 or on the faceplate for scale selection.) The first selection, as seen on the left portion of the display, is "d" for diamond *(used with the Rockwell C, A or D scales)*. As the operator presses the SELECT key a second, third and fourth time, the display will change to show "b" for ball indenter *(for the Rockwell B, E, F, and all other regular Rockwell range ball scales)*, "n" *(for the superfical Rockwell "n" scale (HRN) which uses a diamond)* or "t" *(for Rockwell superficial range ball scales HRT, HRW, HRX, and HRY)*. Press the ENTER key to choose any of these scales.

Please refer to the chart in Section 6 for a complete list of scales.

2. Set the time-at-load by pressing the SELECT key within a two seconds after selecting the range/indenter, tehn the ENTER and SELECT keys. The display will scroll through the time at load selections:1, 2, 3, 4, 5, 6, 8, 10, 15, 30, or 99 seconds. Press the ENTER key to stop the scrolling and choose the time-at-load that is on the display when the key is pressed. If the operator misses his selection, the scrolling will repeat the sequence till the ENTER key is pressed. If the operator does not want to change the time at load, it will remain with the same setting if the select key is not pressed within the required time period. The time-at-load selection will operate for all scales until it is changed.

3. Install the proper indenter, either the diamond or a ball indenter. Unscrew the allen screw holding the indenter in place, remove the indenter and install the desired indenter.

4. Set the Superficial (15, 30, or 45kg) or Regular Rockwell (60, 100, or 150kg) load range with the lever on the lower right side of the tester. This is for proper selection of preload or preliminary test force.



5. Set the proper full load with the knob on the upper right side of the tester.

NOTE: The indenters

are stored inside the door on the left side of the tester. They thread into place into the door.

2.2 Set the Tolerance Settings

1. Set the low tolerance by pressing the SELECT key four times. The left display will show the "d", "b", "n", "I", then "L" will appear in the right side display. This stands for "lower" tolerance. The current setting will appear when the operator presses the ENTER key. To change the setting, press the SELECT key and the display will show "L-.0" At this point the operator can adjust the tenth point low tolerance setting. As the operator repeatedly presses the SELECT key, the .0 will move from 0 to 1, to 2, to 3, etc. Press the ENTER key at any time to choose that setting. The display will change to show the single point. The same procedure is followed for selecting that setting then repeated again for the final numeric value.

2. To change the high tolerance setting press the SELECT key until the display will show "H" in the right side display. The operator continues setting the high tolerance just as he set the low tolerance.

NOTE: If the operator does not want a tolerance setting, he should enter a low tolerance of "0" and a high tolerance of "99.9"

NOTE: If the operator continues to press the SELECT key, the display will show: "CAL.1", "CAL.3", "CAL.n", "CAL.t" and "SET" in sequence. These are factory controlled settings and are not normally changeable by the operator.

2.3 Tester Operation

1. Select a test block and place it on the anvil. Make certain that the test block, elevating screw and the anvil are perfectly clean.

2. Turn the handwheel clockwise to raise the elevating screw and bring the test block into contact with the indenter. Continue turning the handwheel and a series of dashes will appear, one by one, on the display. They appear like this:

_ _ _ . _

3. Still continuing to turn the handwheel a little further, the display will blank out and a single beep will be heard. At this point the operator must stop turning the handwheel. If the operator overtravels on the preload application a series of beeps will be heard. This invalidates the test and the operator should move to another location on the test specimen and restart the entire test procedure.

4. At this point the tester will automatically apply the major load. The time-at-load setting will count down on the display after the major load is reached.

5. After the load is applied for the proper length of time, it will automatically be removed and the test result will be displayed. If the test result exceeds a tolerance setting, the test result will be preceded by a blinking “H” or “L” for high or low result.

6. To take a second test, the handwheel must be turned counter-clockwise to lower the indenter from the test specimen before another test can be taken. Select another test location before proceeeding.

NOTE: If the operator applies too much preload, the specimen shifts under load, or some other condition occurs that spoils the test, the tester will display “Err” for error. Lower the elevating screw and return to the start point to perform another test. Select another test location before proceeeding.

2.4 CALIBRATION CHECKING

Take a test on a test block that is marked for the proper scale with a value that is close to the hardness of the specimens that are to be tested. Take a test. The test result should fall within the tolerances marked on the test block. If not, check the indenter and cleanliness of the block, anvil, and elevating screw. Also check to see that the weights are hanging in the proper positions.

NOTE: Test blocks may be stored inside of the right-hand door located at the side of the tester.

2.5 ROUTINE MAINTENANCE

The elevating screw and anvil should be cleaned carefully of all dirt and corrosion on a regular basis.

Lubricate the elevating screw twice monthly. Use a light machine oil. The rubber boot lifts off for lubrication. After oiling, run the lead screw up and down several times.

2.6 Other Operational Checks

2.6.1 Checking Vee Anvil Alignment

When round parts have to be tested, the alignment of the indenter tip with the specimen has to be nearly perfect.

1. Insert shallow V anvil.

2. Place a small cylindrical specimen (about 1/8" diameter) on the anvil.

3. Bring the specimen close to the diamond indenter without making contact.

4. Check the alignment in two positions, rotating the anvil 90 degrees each time. The tip of the diamond must line up precisely with center of the specimen.

2.6.2 Adjusting the Vee Anvil Alignment

1. Remove the anvil and collar under the anvil after loosening the Allen set screw.

2. Pop the three screw covers off the handwheel and remove the Allen head screws underneath.

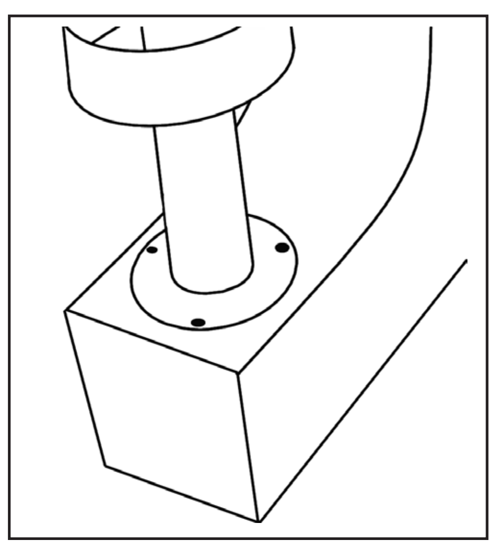
3. Lift the entire elevating screw assembly from the tester, being careful not to impact the indenter.

4. Remove the bearing cover by rotating slightly and lifting off. This will expose the screws that hold the bearing assembly to the stand portion of the tester. 4. Loosen the three screws and reposition the tester as needed. The screws with the cam-like washers are designed to told the cover that was just removed previously.

5. Recheck the alignment and reposition.

6. Tighten the screws and recheck alignment.

7. Reassemble in reverse order.



2.6.3 Clearing History (All the Test Results in Memory)

The NI300 Series Indentron has a memory that may periodically fill up. This causes the display to show an error message: **E17**. To clear the memory follow this procedure:

1. Press the Select Button until the display reads: *STAT*   Press [Enter].

2. The display will change to read: *A OF* Press [Select].

3. The display will change to read: *CLR* Press [Enter].

4. The display will change to read: *LST*   Press [Select]

5. The display will change to read: *ALL* Press [Enter].

6. The tester should then return to the last scale the tests were being taken.

7. Take a test to double check that the memory is clear and the tester is functioning.

2.6.4 Turning Off History

The history can be turned on and off so the data is either stored or not stored at the option of the operator. If data history is turned off, the History will not need to be cleared periodically. To turn history on/off hold the SELECT key for four seconds and then press the ENTER key.

3. SPECIFICATIONS

3.1 Tester Specifications

3.1.1 Dimensions

- Base: 27" L x 11-1/2" W x 30" H
- Vertical Capacity: 10" or 15” depending on model
- Horizontal Capacity: 6"
- Approx Weight: 300 lbs.

3.1.2 Power Requirements

- 115V 50/60 HZ Single Phase (220 and 440 V optional)

3.1.3 Electronic Output Specifications

-A typical printout appears as such:

008 60.2H

- The following is the format of the “Print Results” output of test values to the printer.

###bHHHT

where:

= The sequence number
b = blank space
HHH = The hardness result
T = The tolerance indicator

The total length is 9 characters. All 9 characters are printed regardless of whether or not tolerance values are set. If a tolerance value are not specified, the last character is blank.

- The format is Serial RS-232 and the individual bytes are as follows:
    - 1 start bit
    - 1 stop bit
    - 8 data bits
    - No parity
    - 300 baud, non-adjustable
    - Carriage returns and line feed messages are sent after the 9 character data string

-Connector -Amphenol type

- Pin assignment
    - 1 serial out
    - 2 ground

3.2 Standard Accessories

These accessories and parts are included in the accessory kit.

- Diamond Indenter, C and/or N scales (depending on model)
- 1/16" Ball Indenter with [10] Extra 1/16" Balls
- Test Blocks, C, B, 30N, 30T scales (depending on model)
- 70mm Flat, Reversible Spot/small vee, Vee Anvil
- Vinyl Cover
- Set of Wrenches
- Power Cord

3.3 SPARE PARTS AND ACCESSORIES

PART #	DESCRIPTION
Diamond Indenters	
9110	Certified A, C & N scale diamond (w/ certificate)
8101	International Grade - A scale
8103	International Grade - C scale
8105	International Grade - C & N scales
8108	Domestic Grade - A scale
8109	N scale (Domestic/International Grade**)
8110	Domestic Grade - C scale
NI-SP3	*Short Form* Diamond Indenter
NI-SP9	*Special* Diamond Indenter (tapered, chisel, single double cutaway - call for information)
NI-SP22A	*Special* Extended Diamond for clamp adapter Use with NI-SP22 (at right.)

Note: International Grade diamonds are made to conform to dimensional specifications according to NAMUS (English Standards Organization) and are not polished as opposed to the domestic grade which meet a performance standard. The International Grade read slightly higher than the domestic and are commonly used in conjunction with the Yamamoto test blocks which will read correctly.
**N-Scale Diamonds read the same for both international and domestic grade

PART #	DESCRIPTION
Ball Indenters	
8111	1/16" Ball Indenter with 50 extra balls
NI-SP4	1/16" *Short Form* ball indenter w/ 10 extra balls
8112	1/8" Ball Indenter with 10 extra balls
8113	1/4" Ball Indenter
8114	1/2" Ball Indenter
NI-SP8	3/4" ball indenter
8118M	1/16" Ball Indenter Cap Only
AT/5112C	1/8" Carbide Ball Only
AT/5116	Qty 50, 1/16" Steel Balls
AT/5116C	1/16" Carbide Ball Only
AT/5117	Qty 10, 1/8" Steel Balls
Anvils	
NI-SP10	8" anvil table
NI-SP11	*Short* Workrest
NI-SP12	*Extended* Workrest
NI-SP13A	Standard 70mm (2-3/4") flat anvil
NI-SP13B	Standard combination spot and vee anvil
NI-SP17	Self-Aligning Cylinder type Vee anvil for use with NI-SP11 or NI-SP12 Workrests
NI-SP19	Adjustable cylinder type Vee anvil
NI-SP21	Diamond Spot Anvil
NI-SP25	2" Extended Spot Anvil (includes locking ring)
Other Accessories	
NI-SP18	External Jack Support (for 10" machines)
NI-SP20	Dust Cover (specify model)
NI-SP22*	Clamping adapter for any model Indentron. Includes extended diamond & 1/16" ball indenters
NI130-B	Floor cabinet w/ locking door and drawer
NI-07	Adapter to use "Wilson A" style (no internal thread) indenters in any model Indentron
AT130-PR	Printer w/cable. Dot Matrix, 80 Col., Plain Paper
DATAVIEW	Data software system
NI/5510	Gooseneck Lamp
NI-08	Indenter Gripsel
SC0046	Indenter Holding Screw
ATD98	Printer cable, 25 pin, 6 ft

* 450 in./lb capacity - divide 450 by length of part in inches to determine approx. weight that the part can be.

4. TROUBLESHOOTING AND MAINTENANCE

4.1 Maintenance Procedures

Occasional cleaning is recommended for the elevating screw, height adjuster, anvils, and indenter support area. For long term storage, apply a light oil to elevating screw and anvils.

4.2 Troubleshooting

Please do not open the readout box except at the direction of Newage Customer Service. If you think you need service, please review the Troubleshooting Section before you call.
Get an exact description of the problem - be as specific as possible. Before you call, get the model and serial number of your unit (located on back of readout).

4.2.1 Pre-trouble Shooting Check List

- Is the current load and indenter being used?
- Is the indenter chipped or flattened?
- If checking rounds, is the V anvil alignment OK? (See section on V alignment)
- Are all connectors tight?
- Is the power turned on?

If these items have been checked, please continue to the next section.

4.2.2 Error Codes

If any of these error codes, except E-17, appear please call Newage Testing Instrumetns for help. If E17 appears follow the directions in Section 2-3 for clearing the test results.

CODE	MEANING	CAUSE
E1	System Failure	
E2	Out of Range	Bad A/D
E3	Not stable	A/D not stable
E4	Off scale	Reading too low
E5	Invalid test	Negative result
E6	Bad Test	Operator tries calibration or conversion using invalid test.
E7	Invalid test	Test too fast
E8	No History	No test stored
E9	Motor timeout	Motor not working on motorized units
E10	Not allowed	Load not calibrated for that scale.
E11-16	Calc Error	Mathematical error by microprocessor
E17	History full	No more memory available, clear all
E18	Not allowed	Calibration attempted greater than spec
E18	Invalid load	Load out of specification
E19	Receive timeout	Connection to x/y table not working
E20	Transmit timeout - Internal VART failure	
E21	Table timeout - Mechanical failure of table or limit switches overtravel	
E22	Table error - Connection to x/y table not working	

4.2.3 Troubleshooting Guide

Symptom	Problem	Check/Remedy
Low readings on test block.	Bad test block.	Try different test block.
.	Bad indenter.	Substitute new indenter or switch from diamond indenter to ball or vice versa and check calibration on appropriate test block.
	Loose indenter.	Check for proper seating of indenter
.	Inaccurate test load	Check for proper load selection.
	Test positions too close to edge or each other	Make test more than 3 impression diameters apart or from edge.
.	Specimen dirty or deformation on indenter seat.	Remove indenter and clean contact areas or substitute a new component and clean.
	Bad transducer settings (digital test heads)	Check for LVDT # on MODE key "Continuous On" function
	Electronic error in penetration depth to Rockwell value calculation.	Check for "arrowhead" appearing at right side of display (if so, call factory).
	Bad test block.	Try different test block.
High reading on part.	Test indentations too close ogether.	Keep test indentations 2 ½ diameters apart.
	Bad indenter.	Substitute indenters or switch from ball to diamond and retest on test block.
	Time-at-load not long enough (especially on softer materials).	Set time-at-load for 10 seconds on digital test heads. Hold load lever down longer on analog test heads.
	Inaccurate test load	Check for proper load and selection if the test result is off by more than 2 pts.
	No round correction factor.	If testing on round specimens under 1 ½",
	Vee anvil misalignment.	See instruction for vee anvil alignment
	Test specimen does not meet minimum thickness requirements.	Test on test block
	Bad transducer setting (digital test heads).	Check for LVDT# on Mode key "Continuous-On" function.
	Electronic error in indenter depth to Rockwell value calculation	Check for arrowhead symbol on right side of the display - Call Newage to resolve.

Symptom	Problem	Check/Remedy
High reading on part.	Test specimen positioned too far from the indenter.	Raise specimen to within 1/16” of indenter
Erratic readings.	Damaged indenter.	Replace indenter or substitute ball for diamond (or vice-versa) and retest on appropriate test block.
	Surface condition of test specimen too rough.	Test on test block.
	Inconsistent power supply voltage.	Check for stability of transducer - output in Continuous-On function (Section 4.4.8)
No display (digital testers)	No power to test head	Check cord and power supply
	Fuse blown	Check fuse
Flickering display (digital testers)	Erratic power connection	Check power cord, cable and power supply source.
No change of display during test (ME-2RDS/SRDS).	Tester not “ready”.	Test head must show “Ready” or previous test result (Press NO key.)
	Transducer slipped.	Check transducer position in MODE key “Continuous-On” function.
	Preload switch not plugged in.	Check all electrical connections
	Specimen positioned too far from indenter	Position indenter 1/16” or less from specimen.
	Bad contact.	Press keys firmly in the middle of the key.
Keypad functions won’t work (digital heads ME-2RDS)	Security code not activated for that key.	Follow security code procedure
Breaking diamonds.	Bad vee alignment.	See Section for Vee anvil alignment
	Testing too close to edge of specimen.	Test further from edge.
Display reads “Clear Memory” when turned on.	Electric noise had failed memory or low battery.	Press YES to “Clear Memory” message, then turn unit off then back on again. If message reappears, change memory battery.
Display shows error code Invalid test appears on display.	Too much part deflection under load.	See calibration section
	Operator (machine) error during test cycle.	Test on test block. If message persists, see Troubleshooting: low readings.
		Review basic operation section.
		See error codes to troubleshoot
		If error persists, call factory.

5. SERVICE AND REPAIRS

Call Newage Customer Service if you have questions at 215-526-2200. We may be able to help troubleshoot the problem by phone or refer you to one of our field service representatives. To schedule service call 317-329-4300

Should it be necessary to return the instrument, return the test head (see below for removal) and readout box. Return all intenders with the test head.

6. Reference Tables, ASTM E-18

6.1 Rockwell Scale Reference Table

Scale Symbol	Penetrator	Major Load, kgf	Dial Figures	Typical Applications of Scales
B	1/16—in. ball	100	red	Copper alloys, soft steels, aluminum alloys, malleable iron, etc.
C	diamond	150	black	Steel, hard cast irons, pearlitic malleable iron, titanium, deep case hardened steel, and materials harder than B 100.
A	diamond	60	black	Cemented carbides, thin steel, and shallow case-hardened steel.
D	diamond	100	black	Thin steel and medium case hardened steel, and pearlitic malleable iron.
E	1/8-in. ball	100	red	Cast iron, alumimum and magnesium alloys, bearing metals.
F	1/16-in. ball	60	red	Annealed copper alloys, thin soft sheet metals.
G	1/16-in. ball	150	red	Malleable irons, copper-nickel-zinc and cupro-nickel alloys. Upper limit G 92 to avoid possible flattening of ball.
H	1/8-in. ball	60	red	Aluminum, zinc, lead.
K	1/8-in. ball	150	red	Bearing metals and other very soft or thin materials. Use smallest ball and heaviest load that does not give an anvil effect.
L	1/4-in. ball	60	red	
M	1/4-in. ball	100	red	
P	1/4-in. ball	150	red	
R	1/2-in. ball	60	red	
S	1/2-in. ball	100	red	
V	1/2-in. ball	150	red	

6.2 Superficial Rockwell Scale Reference Table

Scale Symbol	Penetrator	Load in Kilograms
15N	N Diamond	15 kgf
30N	N Diamond	30 kgf
45N	N Diamond	45 kgf
15T	1/16" ball	15 kgf
30T	1/16" ball	30 kgf
45T	1/16" ball	45 kgf
15W	1/8" ball	15 kgf
30W	1/8" ball	30 kgf
45W	1/8" ball	45 kgf
15X	1/4" ball	15 kgf
30X	1/4" ball	30 kgf
45X	1/4" ball	45 kgf
15Y	1/2" ball	15 kgf
30Y	1/2" ball	30 kgf
45Y	1/2" ball	45 kgf

6.3 Minimum Thickness Requirement

TABLE 7 A Guide for Selection of Scales Using the Diamond Indenter (see Fig. 6)

NOTE—For a given thickness, any hardness greater than that corresponding to that thickness can be tested. For a given hardness, material of any greater thickness than that corresponding to that hardness can be tested on the indicated scale.

Thickness		Rockwell Scale		
		A		C
in.	mm	Hardness Reading	Approximate Hardness C-Scale[A]	Dial Reading
0.014	0.36	...	...	...
0.016	0.41	86	69	...
0.018	0.46	84	65	...
0.020	0.51	82	61.5	...
0.022	0.56	79	56	69
0.024	0.61	76	50	67
0.026	0.66	71	41	65
0.028	0.71	67	32	62
0.030	0.76	60	19	57
0.032	0.81	...	...	52
0.034	0.86	...	...	45
0.036	0.91	...	...	37
0.038	0.96	...	...	28
0.040	1.02	...	...	20

[A] These approximate hardness numbers are for use in selecting a suitable scale and should not be used as hardness conversions. If necessary to convert test readings to another scale, refer to Hardness Conversion Tables E 140 (Relationship Between Brinell Hardness, Vickers Hardness, Rockwell Hardness, Rockwell Superficial Hardness, and Knoop Hardness).

TABLE 8 A Guide for Selection of Scales Using the 1/16-in. (1.588-mm) Diameter Ball Indenter (see Fig. 7)

NOTE—For a given thickness, any hardness greater than that corresponding to that thickness can be tested. For a given hardness, material of any greater thickness than that corresponding to that hardness can be tested on the indicated scale.

Thickness		Rockwell Scale		
		F		B
in	mm	Hardness Reading	Approximate Hardness B-Scale[A]	Hardness Reading
0.022	0.56	...	...	...
0.024	0.61	98	72	94
0.026	0.66	91	60	87
0.028	0.71	85	49	80
0.030	0.76	77	35	71
0.032	0.81	69	21	62
0.034	0.86	...	...	52
0.036	0.91	...	...	40
0.038	0.96	...	...	28
0.040	1.02	...	...	...

[A] These approximate hardness numbers are for use in selecting a suitable scale and should not be used as hardness conversions. If necessary to convert test readings to another scale refer to Hardness Conversion Tables E 140 (Relationship Between Brinell Hardness, Vickers Hardness, Rockwell Hardness, Rockwell Superficial Hardness and Knoop Hardness).

TABLE 9 A Guide for Selection of Scales Using the Diamond Indenter (see Fig. 6)

NOTE—For a given thickness, any hardness greater than that corresponding to that thickness can be tested. For a given hardness, material of any greater thickness than that corresponding to that hardness can be tested on the indicated scale

Thickness		Rockwell Superficial Scale					
		15N		30N		45N	
in.	mm	Hardness Reading	Approximate Hardness C-Scale[A]	Hardness Reading	Approximate Hardness C-Scale[A]	Hardness Reading	Approximate Hardness C-Scale[A]
0.006	0.15	92	65	...	...	...	...
0.008	0.20	90	60	...	...	...	...
0.010	0.25	88	55	...	...	...	...
0.012	0.30	83	45	82	65	77	69.5
0.014	0.36	76	32	78.5	61	74	67
0.016	0.41	68	18	74	56	72	65
0.018	0.46	...	...	66	47	68	61
0.020	0.51	...	...	57	37	63	57
0.022	0.56	...	...	47	26	58	52.5
0.024	0.61	...	...	...	...	51	47
0.026	0.66	...	...	...	...	37	35
0.028	0.71	...	...	...	...	20	20.5
0.030	0.76	...	...	...	...	...	...

[A] These approximate hardness numbers are for use in selecting a suitable scale, and should not be used as hardness conversions. If necessary to convert test readings to another scale, refer to Hardness Conversion Tables E 140 (Relationship Between Brinell Hardness, Vickers Hardness, Rockwell Hardness, Rockwell Superficial Hardness and Knoop Hardness).

6.4 Round Correction Table

TABLE 11 Corrections to Be Added to Rockwell C, A, and D Values Obtained on Convex Cylindrical Surfaces[A] of Various Diameters

Dial Reading	Diameters of Convex Cylindrical Surfaces								
	1/4 in. (6.4 mm)	3/8 in. (10 mm)	1/2 in. (13 mm)	5/8 in. (16 mm)	3/4 in. (19 mm)	7/8 in. (22 mm)	1 in. (25 mm)	1 1/4 in. (32 mm)	1 1/2 in. (38 mm)
	Corrections to be Added to Rockwell C, A, and D Values[B]								
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

[A] When testing cylindrical specimens, the accuracy of the test will be seriously affected by alignment of elevating screw, V-anvil, indenters, surface finish, and the straightness of the cylinder.
[B] These corrections are approximate only and represent the averages to the nearest 0.5 Rockwell number, of numerous actual observations.

TABLE 12 Corrections to Be Added to Rockwell B, F, and G Values Obtained on Convex Cylindrical Surfaces[A] of Various Diameters

Hardness Reading	Diameters of Convex Cylindrical Surfaces						
	1/4 in. (6.4 mm)	3/8 in. (10 mm)	1/2 in. (13 mm)	5/8 in. (16 mm)	3/4 in. (19 mm)	7/8 in. (22 mm)	1 in. (25 mm)
	Corrections to be Added to Rockwell B, F, and G Values[B]						
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

[A] When testing cylindrical specimens, the accuracy of the test will be seriously affected by alignment of elevating screw, V-anvil, indenters, surface finish, and the straightness of the cylinder.
[B] These corrections are approximate only and represent the averages to the nearest 0.5 Rockwell number, of numerous actual observations.

TABLE 13 Corrections to Be Added to Rockwell Superficial 15N, 30N, and 45N Values Obtained on Convex Cylindrical Surfaces of Various Diameters[A]

Hardness Reading	Diameters of Convex Cylindrical Surfaces					
	1/8 in. (3.2 mm)	1/4 in. (6.4 mm)	3/8 in. (10 mm)	1/2 in. (13 mm)	3/4 in. (19 mm)	1 in. (25 mm)
	Corrections to be Added to Rockwell Superficial 15N, 30N, and 45N Values[B]					
20	6.0	3.0	2.0	1.5	1.5	1.5
25	5.5	3.0	2.0	1.5	1.5	1.0
30	5.5	3.0	2.0	1.5	1.0	1.0
35	5.0	2.5	2.0	1.5	1.0	1.0
40	4.5	2.5	1.5	1.5	1.0	1.0
45	4.0	2.0	1.5	1.0	1.0	1.0
50	3.5	2.0	1.5	1.0	1.0	0.5
55	3.5	2.0	1.5	1.0	0.5	0.5
60	3.0	1.5	1.0	1.0	0.5	0.5
65	2.5	1.5	1.0	0.5	0.5	0.5
70	2.0	1.0	1.0	0.5	0.5	0.5
75	1.5	1.0	0.5	0.5	0.5	0
80	1.0	0.5	0.5	0.5	0	0
85	0.5	0.5	0.5	0.5	0	0
90	0	0	0	0	0	0

[A] When testing cylindrical specimens the accuracy of the test will be seriously affected by alignment of elevating screw, V-anvil, indenters, surface finish, and the straightness of the cylinder.
[B] These corrections are approximate only and represent the averages, to the nearest 0.5 Rockwell superficial number, of numerous actual observations.

TABLE 14 Corrections to Be Added to Rockwell Superficial 15T, 30T, and 45T Values Obtained on Convex Cylindrical Surfaces[A] of Various Diameters

Hardness Reading	Diameters of Convex Cylindrical Surfaces						
	1/8 in. (3.2 mm)	1/4 in. (6.4 mm)	3/8 in. (10 mm)	1/2 in. (13 mm)	5/8 in. (16 mm)	3/4 in. (19 mm)	1 in. (25 mm)
	Corrections to be Added to Rockwell Superficial 15T, 30T, and 45T Values[B]						
20	13.0	9.0	6.0	4.5	4.5	3.0	2.0
30	11.5	7.5	5.0	3.5	3.5	2.5	2.0
40	10.0	6.5	4.5	3.5	3.0	2.5	2.0
50	8.5	5.5	4.0	3.0	2.5	2.0	1.5
60	6.5	4.5	3.0	2.5	2.0	1.5	1.5
70	5.0	3.5	2.5	2.0	1.5	1.0	1.0
80	3.0	2.0	1.5	1.5	1.0	1.0	0.5
90	1.5	1.0	1.0	0.5	0.5	0.5	0.5

[A] When testing cylindrical specimens, the accuracy of the test will be seriously affected by alignment of elevating screw, V-anvil, indenters, surface finish, and the straightness of the cylinder.
[B] These corrections are approximate only and represent the averages, to the nearest 0.5 Rockwell superficial number, of numerous actual observations.

6.5 Hardness Conversion Chart, High Range

TABLE 1 Approximate Hardness Conversion Numbers for Non-Austenitic Steels (Rockwell C to Other Hardness Numbers)

		Brinell Hardness Number[A]		Rockwell Hardness Number		Rockwell Superficial Hardness Number				
Rockwell C Hardness Number	Vickers Hardness Number	10-mm Standard Ball, 3000-kgf Load	10-mm Carbide Ball, 3000-kgf Load	A Scale, 60-kgf Load, Diamond Penetrator	D Scale, 100-kgf Load, Diamond Penetrator	15-N Scale, 15-kgf Load, Superficial Diamond Penetrator	30-N Scale, 30-kgf Load, Superficial Diamond Penetrator	45-N Scale, 45-kgf Load, Superficial Diamond Penetrator	Scleroscope Hardness[B]	Rockwell C Hardness Number
68	940	...	...	85.6	76.9	93.2	84.4	75.4	97.3	68
67	900	...	...	85.0	76.1	92.9	83.6	74.2	95.0	67
66	865	...	...	84.5	75.4	92.5	82.8	73.3	92.7	66
65	832	...	**739**	83.9	74.5	92.2	81.9	72.0	90.6	65
64	800	...	**722**	83.4	73.8	91.8	81.1	71.0	88.5	64
63	772	...	**705**	82.8	73.0	91.4	80.1	69.9	86.5	63
62	746	...	**688**	82.3	72.2	91.1	79.3	68.8	84.5	62
61	720	...	**670**	81.8	71.5	90.7	78.4	67.7	82.6	61
60	697	...	**654**	81.2	70.7	90.2	77.5	66.6	80.8	60
59	674	...	**634**	80.7	69.9	89.8	76.6	65.5	79.0	59
58	653	...	**615**	80.1	69.2	89.3	75.7	64.3	77.3	58
57	633	...	**595**	79.6	68.5	88.9	74.8	63.2	75.6	57
56	613	...	**577**	79.0	67.7	88.3	73.9	62.0	74.0	56
55	595	...	**560**	78.5	66.9	87.9	73.0	60.9	72.4	55
54	577	...	**543**	78.0	66.1	87.4	72.0	59.8	70.9	54
53	560	...	525	77.4	65.4	86.9	71.2	58.6	69.4	53
52	544	**500**	512	76.8	64.6	86.4	70.2	57.4	67.9	52
51	528	**487**	496	76.3	63.8	85.9	69.4	56.1	66.5	51
50	513	**475**	481	75.9	63.1	85.5	68.5	55.0	65.1	50
49	498	**464**	469	75.2	62.1	85.0	67.6	53.8	63.7	49
48	484	451	455	74.7	61.4	84.5	66.7	52.5	62.4	48
47	471	442	443	74.1	60.8	83.9	65.8	51.4	61.1	47
46	458	432	432	73.6	60.0	83.5	64.8	50.3	59.8	46
45	446	421	421	73.1	59.2	83.0	64.0	49.0	58.5	45
44	434	409	409	72.5	58.5	82.5	63.1	47.8	57.3	44
43	423	400	400	72.0	57.7	82.0	62.2	46.7	56.1	43
42	412	390	390	71.5	56.9	81.5	61.3	45.5	54.9	42
41	402	381	381	70.9	56.2	80.9	60.4	44.3	53.7	41
40	392	371	371	70.4	55.4	80.4	59.5	43.1	52.6	40
39	382	362	362	69.9	54.6	79.9	58.6	41.9	51.5	39
38	372	353	353	69.4	53.8	79.4	57.7	40.8	50.4	38
37	363	344	344	68.9	53.1	78.8	56.8	39.6	49.3	37
36	354	336	336	68.4	52.3	78.3	55.9	38.4	48.2	36
35	345	327	327	67.9	51.5	77.7	55.0	37.2	47.1	35
34	336	319	319	67.4	50.8	77.2	54.2	36.1	46.1	34
33	327	311	311	66.8	50.0	76.6	53.3	34.9	45.1	33
32	318	301	301	66.3	49.2	76.1	52.1	33.7	44.1	32
31	310	294	294	65.8	48.4	75.6	51.3	32.5	43.1	31
30	302	286	286	65.3	47.7	75.0	50.4	31.3	42.2	30
29	294	279	279	64.8	47.0	74.5	49.5	30.1	41.3	29
28	286	271	271	64.3	46.1	73.9	48.6	28.9	40.4	28
27	279	264	264	63.8	45.2	73.3	47.7	27.8	39.5	27
26	272	258	258	63.3	44.6	72.8	46.8	26.7	38.7	26
25	266	253	253	62.8	43.8	72.2	45.9	25.5	37.8	25
24	260	247	247	62.4	43.1	71.6	45.0	24.3	37.0	24
23	254	243	243	62.0	42.1	71.0	44.0	23.1	36.3	23
22	248	237	237	61.5	41.6	70.5	43.2	22.0	35.5	22
21	243	231	231	61.0	40.9	69.9	42.3	20.7	34.8	21
20	238	226	226	60.5	40.1	69.4	41.5	19.6	34.2	20

[A] The Brinell hardness numbers in boldface type are outside the range recommended for Brinell hardness testing in 3.2.2 of Test Method E 10.

[B] These Scleroscope hardness conversions are based on Vickers—Scleroscope hardness relationships developed from Vickers hardness data provided by the National Bureau of Standards for 13 steel reference blocks, Scleroscope hardness values obtained on these blocks by the Shore Instrument and Mfg. Co., Inc., the Roll Manufacturers Institute, and members of this institute, and also on hardness conversions previously published by the American Society for Metals and the Roll Manufacturers Institute.

6.6 Hardness Conversion Chart, Low Range

TABLE 2 Approximate Hardness Conversion Numbers for Non-Austenitic Steels (Rockwell B to Other Hardness Numbers)

						Rockwell Superficial Hardness			
Rockwell B Scale, 100-kgf Load, 1/16-in. (1.588-mm) Ball	Vickers Hardness Number	Brinell Hardness, 3000-kgf Load, 10-mm Ball	Knoop Hardness, 500-g Load and Over	Rockwell A Scale, 60-kgf Load, Diamond Penetrator	Rockwell F Scale, 60-kgf Load, 1/16-in. (1.588-mm) Ball	15-T Scale, 15-kgf Load, 1/16-in. (1.588-mm) Ball	30-T Scale, 30-kgf Load, 1/16-in. (1.588-mm) Ball	45-T Scale, 45-kgf Load, 1/16-in. (1.588-mm) Ball	Rockwell B Scale, 100-kgf Load, 1/16-in. (1.588-mm) Ball
100	240	240	251	61.5	...	93.1	83.1	72.9	100
99	234	234	246	60.9	...	92.8	82.5	71.9	99
98	228	228	241	60.2	...	92.5	81.8	70.9	98
97	222	222	236	59.5	...	92.1	81.1	69.9	97
96	216	216	231	58.9	...	91.8	80.4	68.9	96
95	210	210	226	58.3	...	91.5	79.8	67.9	95
94	205	205	221	57.6	...	91.2	79.1	66.9	94
93	200	200	216	57.0	...	90.8	78.4	65.9	93
92	195	195	211	56.4	...	90.5	77.8	64.8	92
91	190	190	206	55.8	...	90.2	77.1	63.8	91
90	185	185	201	55.2	...	89.9	76.4	62.8	90
89	180	180	196	54.6	...	89.5	75.8	61.8	89
88	176	176	192	54.0	...	89.2	75.1	60.8	88
87	172	172	188	53.4	...	88.9	74.4	59.8	87
86	169	169	184	52.8	...	88.6	73.8	58.8	86
85	165	165	180	52.3	...	88.2	73.1	57.8	85
84	162	162	176	51.7	...	87.9	72.4	56.8	84
83	159	159	173	51.1	...	87.6	71.8	55.8	83
82	156	156	170	50.6	...	87.3	71.1	54.8	82
81	153	153	167	50.0	...	86.9	70.4	53.8	81
80	150	150	164	49.5	...	86.6	69.7	52.8	80
79	147	147	161	48.9	...	86.3	69.1	51.8	79
78	144	144	158	48.4	...	86.0	68.4	50.8	78
77	141	141	155	47.9	...	85.6	67.7	49.8	77
76	139	139	152	47.3	...	85.3	67.1	48.8	76
75	137	137	150	46.8	99.6	85.0	66.4	47.8	75
74	135	135	147	46.3	99.1	84.7	65.7	46.8	74
73	132	132	145	45.8	98.5	84.3	65.1	45.8	73
72	130	130	143	45.3	98.0	84.0	64.4	44.8	72
71	127	127	141	44.8	97.4	83.7	63.7	43.8	71
70	125	125	139	44.3	96.8	83.4	63.1	42.8	70
69	123	123	137	43.8	96.2	83.0	62.4	41.8	69
68	121	121	135	43.3	95.6	82.7	61.7	40.8	68
67	119	119	133	42.8	95.1	82.4	61.0	39.8	67
66	117	117	131	42.3	94.5	82.1	60.4	38.7	66
65	116	116	129	41.8	93.9	81.8	59.7	37.7	65
64	114	114	127	41.4	93.4	81.4	59.0	36.7	64
63	112	112	125	40.9	92.8	81.1	58.4	35.7	63
62	110	110	124	40.4	92.2	80.8	57.7	34.7	62
61	108	108	122	40.0	91.7	80.5	57.0	33.7	61
60	107	107	120	39.5	91.1	80.1	56.4	32.7	60

Appendix A: STATISTICAL SOFTWARE INSTRUCTIONS (OPTIONAL)

This optional software allows the tester to store test data and perform certain statistical functions. The information can be downloaded to a printer or other device, or viewed in a limited capacity on the tester display.

Press the SELECT key to display the possible selections in this sequence: d, b, n, t, and r appearing in the left display; L. H. StA.t. Prn.t. CALL. CALM. CALM, CAL.:. and SEt appearing in the right display.

Note: Because of the way the segments are arranged in each LED, display characters appear in both upper and lower case form, for example: GrA.F is the designation for the word ‘’GRAPH. StA.t is the designation for the word “STATISTiCS”.

The STAT and PRINT features each contain these multiple functions:

STATISTICS:

AVERAGE OF appearing as [A] [OF .]

Used to set up the tester to automatically average between 2 and 9 tests. The tester will display and print each individual test result and then the average after the last test in the sequence is taken. The letter A will appear in the left display to indicate an averaged test result. These averaged results will be stored in memory under a single sequence number. The individual testes will not be stored.

CLEAR appearing as [ ] [CLr]

Allows the operator to clear the last test or all tests from the tester’s memory.

AVERAGE appearing as [A] [xxx.x]

Displays the average reading of all test results in memory.

STANDARD DEVIATION appearing as [S] [xxx.x]

Displays the standard deviation of all test results in memory.

PRINTING:

TOTALS appearing as [ ] [t0t .]

Prints out the SPC values for the test results stored in memory.

HISTORY appearing as [ ] [HIS.t]

Prints out the test results in memory.

GRAPH appearing as [ ] [GrA.F]

Generates a frequency distribution diagram (histogram) showing the readings in a certain lot grouped in ranges, with the indication of results in each range.

To access the STAT functions:

1. Press the SELECT key until the display reads StA..t . Press the ENTER key.
2. Press the SELECT key again to advance through the available functions.
3. Press the ENTER key to choose the desired function:

AVERAGE OF

Press ENTER when the display reads A OF . to choose the automatic averaging mode.
Press the SELECT key to scroll through the number of tests to be averaged from 2 to 9.
Press ENTER to select the desired number. (Use 0 to turn off this function.)

CLEAR

Press ENTER when the display reads CLr. to choose the CLEAR mode. The display will then read: LSt. .
Press ENTER to clear the last test taken.
OR
Press SELECT to advance to the next choice. The display will read: ALL. .
Press ENTER to clear all tests from memory

AVERAGE

· Press ENTER when the display reads A to display the average of all test results in memory.

STANDARD DEVIATION

Press ENTER when the display reads S to display the standard deviation of all test results in memory.

To access the PRINT functions:

1. Press the SELECT key until the display reads Prn.t . Press the ENTER key.
2. Press the SELECT key again to advance through the available functions.
3. Press the ENTER key to choose the desired function:

TOTALS

Press ENTER to print out the SPC values for the test results stored in memory.

HISTORY

Press ENTER to print out the test results in memory.

GRAPH

Press ENTER to print out a frequency distribution diagram (histogram) showing the readings in a certain lot grouped in ranges, with the indication of results in each range.

SAMPLE TOTALS PRINTOUT: SAMPLE GRAPH PRINTOUT

NEWAGE HARDNESS TESTER

SCALE	SEQ #	0-SET	LOWTOL		HIGHTOL			
D	10	100.0	.0		99.9			
TOT	GOOD	LOW	HIGH	MIN	MAX	CPK	Z-MINUS	Z-PLUS
10	10-ALL	0-0%	0-0%	62.8	63.1	129.89	663.3	389.69

RANGE	AVG	VAR	STD DEV (N-1)	STD DEV (N)	PRED % OUT LOW FROM Z-TABLE	PRED % OUT HIGH FROM Z-TABLE
.3	62.93	.008	.094	.089	.00	.00

SAMPLE HISTORY PRINTOUT

NEWAGE HARDNESS TESTER

SCALE	SEQ #	0-SET	LOWTOL	HIGHTOL
D	10	100.0	62.5	63.0

1: 62.8	D	OK
2: 62.9	D	OK
3: 62.9	D	OK
4: 63.1	D	HI
5: 62.9	D	OK
6: 63.0	D	OK
7: 62.8	D	OK
8: 63.0	D	OK
9: 63.0	D	OK
10: 63.1	D	HI

SAMPLE GRAPH PRINTOUT

```
NEWAGE HARDNESS TESTER

SCALE    SEQ #        0-SET       LOWTOL     HIGHTOL
D        10           100.0       0              99.9

CNT   I
      |
  4   |                      ***
  3   |                    *** ***
  2   |                  *** *** ***
  1   |                  *** *** *** ***
______|___________________________________________________________________________

            62.6     62.8     63.0     63.2     63.4     63.6     63.8     64.0     64.2 —>
      <—        62.7     62.9      63.1     63.3      63.5     63.7     63.9      64.1
              |              |            |
        -3S 62.6
                         AVG 62.9
                                    +3S 63.2
```

The tester will hold the test results in memory even when fumed off unless cleared through the STAT function, or by using the CLEAR MEMORY feature. If the maximum amount of test result memory is reached, the error message E17 will appear on the display. It may be necessary to use the CLEAR MEMORY feature to remove the stored test results and resume normal operation. To do so, use the following procedure:

- Turn the tester OFF.
- When the unit is OFF, press and HOLD both the SELECT and the ENTER keys.
- While holding these two keys, turn the tester ON. A series of dashes should appear on the display.
- Release the two keys and then press the ENTER key.

Appendix B: FACTORY SERVICE & SHIPPING INSTRUCTIONS

MAKE CERTAIN YOUR INSTRUMENT NEEDS TO BE SERVICED:

If the tester will not operate correctly after following the troubleshooting procedures and/or calling Newage support personnel, see below for shipping instructions:

IF YOUR TESTER DOES NEED SERVICE:

1. The indenter and its shroud should be screwed into the head. Any additional indenters should also be included in shipment.

2. Write the name and phone number of a person who can authorize the repair expense. (Newage will call with an estimate after looking at the tester.) Also, include a brief description of the tester problem or requirement, e.g. *Needs calibration* or *Reads high*.

3. Place head, and related accessories in a sturdy box (double-wall cardboard or double boxed, leaving room for at least three (3) inches of fire packing material).

4. Pack the box so the head will not shift in shipment and be certain the indenter and dial indicator or electronics will not be damaged by movement of the head. Mark package with labels indicating “Sensitive Instrument. Handle with care”.

5. Insure for the value of the tester.

6. Ship to:

NewAge Testing Instruments, Inc.
147 James Way
Southampton, PA 18966

215-526-2200

7. NewAge generally can turn repairs around within a week.

NOTE: Emergency Service: Immediate service is available on emergency cases where the test head is to be shipped in via overnight shipment. Call 215-526-2200 and request fast turnaround and return shipment by air freight. No extra charge for this service (other than freight) but we must know your test head is coming and be able to verify that personnel will be available to do the work.

NOTE: When packaging delicate instruments for shipment maximum care must be taken. Please instruct your shipping department to take as many precautions as they can.

NOTE: NewAge policy for warranty repairs is for customer to pay shipping to NewAge. NewAge will pay charges for shipment back to customer.

ONE YEAR LIMITED WARRANTY

Should Newage Testing Instruments, Inc. equipment require service, we will repair or replace, at our option, any part or product which upon examination by a Newage service technician, shows to be defective in material or workmanship.
Excluded from this warranty are any parts that are to be replaced as part of normal product operation, such as indenters, test blocks, and indenter shrouds.

This warranty is extended to the original purchaser only, for a period of one year (12 months) from owners date of purchase.

This warranty IS NOT VALID IF THE INSTRUMENT HAS BEEN MODIFIED, MISUSED OR DAMAGED in any way. This includes damage caused by disassembly by any person other than an authorized Newage Testing Instruments' service technician.

Please read all operating instructions according to the manual supplied with the instrument prior to operation. This warranty applies only to instruments sold by Newage Testing Instruments, Inc. and its authorized distributors.

Newage Testing Instruments, Inc.. is not responsible in any way for losses, damage, or other form of consequential damage resulting from equipment failure or improper use.

IMPORTANT: Register your instrument with Newage Testing Instruments, Inc. service department by filling out and returning the enclosed warranty registration card

NEWAGE
Testing Instruments, Inc.
147 James Way, Southampton, PA 18966
Tel: 215-526-2200 Fax: 215-526-2192
email: info@newageinstruments.com

NEWAGE
Testing Instruments, Inc.
Newage Testing Instruments, Inc.
147 James Way, Southampton, PA 18966, USA
Tel: 800-806-3924 or 215-526-2200, Fax: 215-526-2192
Email: info@newageinstruments.com
www.newageinstruments.com