

BRINELL HARDNESS TESTER

MODEL NB-3010

Including Appendix for Retrofit of HB3000 to NB3010

OPERATING INSTRUCTIONS
V 1.0

Contents

1. APPLICATION INFORMATION	1
2. GENERAL INFORMATION	1
2.1 Technical Data	1
2.2 Items Shipped with Unit	1
2.3 Accessory/Ship Kit Contents	1
2.4 Options	1
3. MECHANICAL DESCRIPTION	2
3.1 Frame and anvil (See Parts Location Diagram on Page 8)	2
3.2 Load Lever Mechanism (See Parts Location Diagram on Page 8)	2
3.3 Rod Assembly (See Parts Location Diagram on Page 8)	2
3.4 Pneumatic Tube Assembly (See Parts Location Diagram on Page 8)	2
3.5 Electronic Control System (See Parts Location Diagram on Page 8)	3
4. INSTALLATION (See Parts Location Diagram on Page 8)	4
Tester Footprint Drawing for bolting the tester to the work table.	4
5. TEST SETUP and OPERATION	6
5.1 Setting up Indenter and Anvil	6
5.2 Selection of Test Load	6
5.3 Load a Test Specimen	7
5.4 Selecting Time-at-load	7
5.5 Initiating a Test	7
5.6 Test Completion	7
5.7 Brinell Scope Measurement	7
6. PARTS LOCATION DIAGRAMS	8
7. THE BRINELL TEST METHOD	9
7.1 The ASTM Specification	9
8. MAINTENANCE	11
9. CONTACT INFORMATION	11
Appendix A: Instructions for Converting NB3010 from Electric to Air	12
Appendix B: Brinell Conversion Charts	15
ONE YEAR LIMITED WARRANTY	18

1. APPLICATION INFORMATION

The tester is used for determining the Brinell hardness of un-quenched steel, cast-iron, nonferrous metals and soft bearing alloys. This tester can be used in metallurgical plants, machine manufacturing plants, metal working plants, industrial laboratories, and laboratory environments.

The measuring range of hardness is 8-450 HBS when steel ball indenter is used, and 8-650 HBW when a tungsten carbide ball indenter is used.

2. GENERAL INFORMATION

2.1 Technical Data

Loads available (kg)	62.5, 187.5, 250, 500, 750, 1000, 1500, 3000
Selectable Time-at-Load	12, 30, 60 sec.
Diameter of ball	10 mm.
Duration of loading	12, 30, 60 sec.
Max. height of test -piece	9"
Depth of throat	4.5"
Power supply	110 V., 60Hz
Dimensions (L x W x H)	9"W x 34"H x 28"D
Net weight	440 lbs.
Air requirements	60 psi, 0.4 cfm.

2.2 Items Shipped with Unit

Set of weights
Weight Hanger
Large Flat Anvil (installed on elevating screw)
Accessory Kit and Ship Kit Contents (see below)

2.3 Accessory/Ship Kit Contents

Flat Anvil	Operating Instructions
Vee Anvil	Hold-down hardware
Power Cord	Set of Leveling Feet
Set of wrenches	[2] spare fuses
Brinell Test Block, HB30	10mm ball indenter with carbide ball and cert.
Brinell Chart	Certificate of calibration for tester

2.4 Options

Foot pedal switch
2.5 and 5 mm indenters
20 X Brinell Scope with multiple adjustment

3. MECHANICAL DESCRIPTION

3.1 Frame and anvil (See Parts Location Diagram on Page 8)

The hardness tester has a cast iron frame (1). An elevating screw seat (18) is set on the stage at the front of the frame. The removable anvil (24) is set on the elevating screw (22), which is fitted precisely into the seat (18). The handwheel (21) elevates the elevating screw. A steel ball detent (19) is located between handwheel (21) and nut (20). When the indenter (25) is in contact with the specimen and reaches certain force as the elevating screw is raised, the handwheel slips which ensure proper force within an allowable range. Set the ball detent to allow the handwheel to slip at the proper point. Check the detent in the lowering mode to set the slippage of the elevating screw.

3.2 Load Lever Mechanism (See Parts Location Diagram on Page 8)

The lever mechanism consists of a large lever (4), small lever (29), hanger (3), and rod (27), etc.. The arm ratio is 1:12.5 for the large lever, 1:4 for the small lever and overall ratio is 1:50 for the lever system. The test force is applied to the test piece by the lever system. On the long arm of large lever is the hanger on which the load weights (7) are suspended. By the combining weights differently, test loads can be changed. (See page 6.) The test force is applied when the pneumatic cylinder's piston rod (6) retracts allowing the weights to descend and apply the load through the fork rocker (5), large lever (4), small lever (29), rod (27), and main shaft (26).

CAUTION: The load weights should be positioned so that they completely overhang the edge of the tabletop on which the tester is installed. If this is not done, whenever the operator fails to raise the indenter to contact against the test specimen, the load weight assembly can over-travel during the test cycle so that the hanger can come off the lever and possibly allow the weights to fall.

3.3 Rod Assembly (See Parts Location Diagram on Page 8)

The rod assembly consists of a spring (28), rod (27), and main shaft (26) etc. While idle, the spring presses the main shaft in the conical hole and cause the rod to remain close to the middle knife support of small lever (29) so as to keep the rod in the proper position. When the test specimen touches the indenter, the main shaft is raised, thus determining the starting position for the test.

3.4 Pneumatic Tube Assembly (See Parts Location Diagram on Page 8)

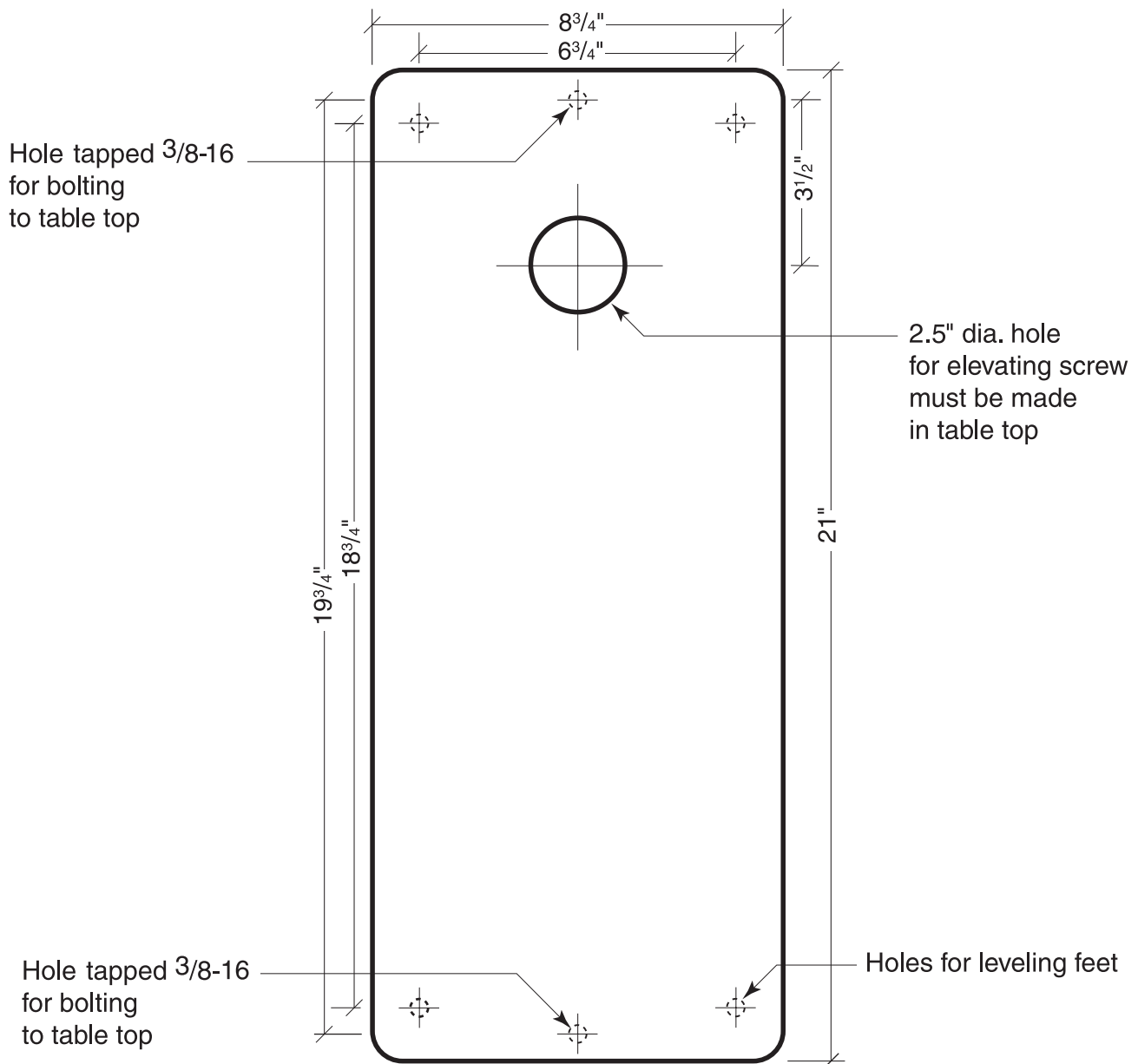
The air regulator should be set at 60 psi. The Pneumatic tube assembly consists of the cylinder mounting bracket (17), the pneumatic cylinder (8), the piston rod (6), the pressure regulator (16), and the fork rocker (5).

3.5 Electronic Control System (See Parts Location Diagram on Page 8)

The electronic control system consists of a solenoid (23) and printed wiring board (30), etc. Depress the start button (5A) to bring the solenoid into action. The pneumatic cylinder (8) starts to empty, and the indicator light for loading (1A) is lit. The piston rod (6) descends, dropping the fork rocker (5) slowly downward and the roller is separated from the large lever. The piston rod is stopped and the electronic face plate light for test duration (2A) is lit as the load is applied. When the duration time (12, 30 or 60 seconds) is completed, the pneumatic cylinder (8) reverses the process by means of the solenoid. The electronic faceplate light for unloading (3A) is lit and the piston rod raises the large lever again. When the roller at the end of the Fork Rocker comes into contact with the limit switch (2) at the rear of the Large Lever (4), the pneumatic cylinder is stopped and the test force is removed.

4. INSTALLATION (See Parts Location Diagram on Page 8)

The tester should be installed in a dry, clean room without corrosive gases or large amount of vibration. The base for the tester should be rigid and flat and able to support weight of tester - 570 lbs. The general footprint dimensions are 9" wide x 21" deep. The tester height is about 34". The tester's leveling feet should be installed and the unit bolted to the work table with the hold-down hardware to prevent the tester from tipping. A 2" hole must be made to accommodate the elevating screw. (Please refer to the drawing below.) After positioning the tester should be leveled using adjustments on the leveling feet.



Tester Footprint Drawing for bolting the tester to the work table.

The weight hanger (3) should be hung on the knife edge of the load lever (4) and the weights added and rotated to different amounts so that the slots on the weights are offset to prevent them from accidentally being knocked off the hanger. (See photo at right) Place the hanger on the knife edge at the end of the large lever. Sufficient space should be maintained for adding and removing of the weights at the rear of the tester. (See following section for hanging weights for proper load

IMPORTANT PRECAUTION: The area underneath the weights should be free from obstruction that would prevent the weights from descending freely during the test cycle - even possibly beyond the bottom of the tester. An obstruction could cause an incorrect test load or even cause the hanger to come off the load lever which could allow the weights to fall.

If the Newage floor cabinet is used with the tester, the ridge in the back of the cabinet is low enough that the weights will not hit as long as the operator uses a test specimen prior to initiating a test - but a test without raising the part to the indenter could still allow the hanger to be dislodged.

The air regulator must be threaded into place on the side of the tester. It is shipped with a 3/8" barb fitting for connection to factory air. It is set for 60 psi. It extends to the right of the tester as viewed by the operator, and care should be taken so that the regulator is not exposed to damage during operation. The minimum air requirements are 60 psi with .4 CFM.

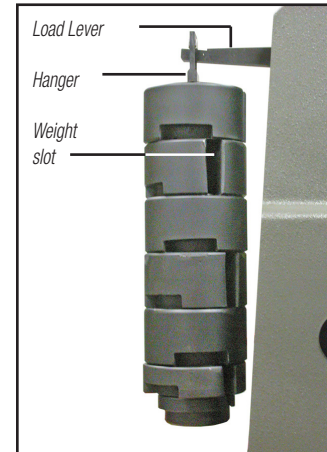
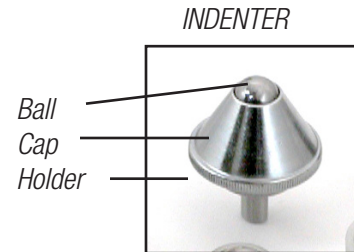
The electrical power is normally 110V and 60Hz (except on units that have been adapted for other power supply requirements) The amperage requirement is very low - millivolts for the electronics.

The indenter and an anvil must be installed - see following section

5. TEST SETUP and OPERATION

5.1 Setting up Indenter and Anvil

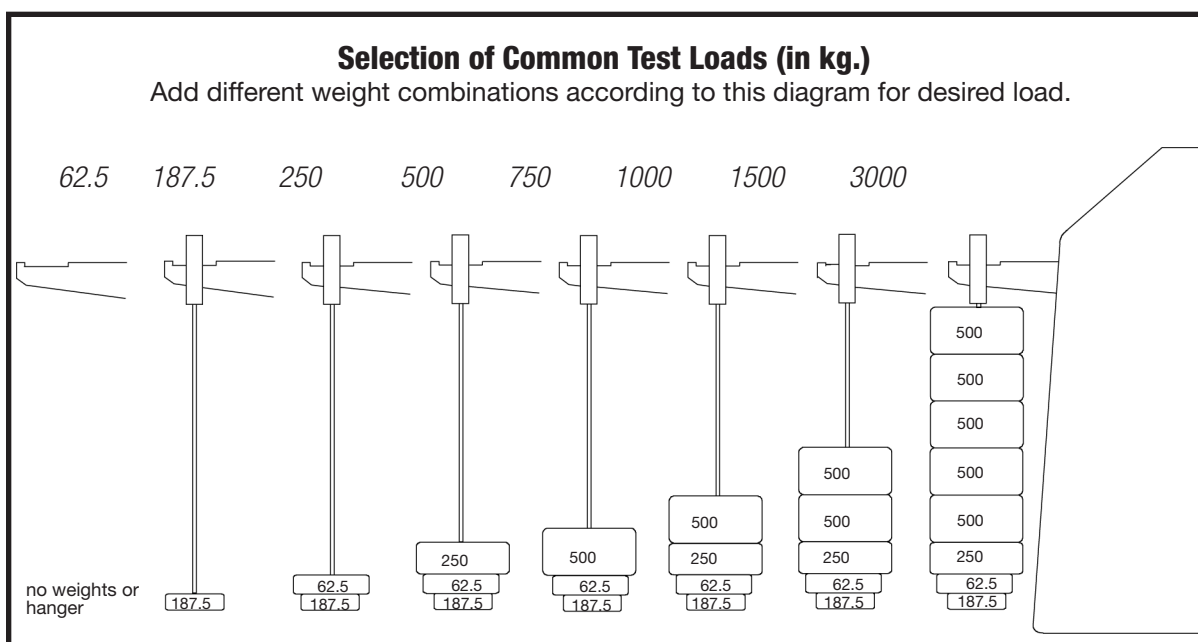
Select the proper indenter according to the desired load in accordance with ASTM E-10. Indenters consist of a ball holder, cap and ball. Clean any oil from the surface of the ball and the ball holder before installing. Spread a little Vaseline on the spherical indentation of the ball holder. Install the tungsten carbide ball, and screw on the indenter cap. The test is invalid if ball is loose, so inspect the ball indenter. Screw the indenter into the main shaft. Then set the anvil (24) on the elevating screw (22).



Showing weights with slots oriented in different directions >

5.2 Selection of Test Load

Place the Hanger (3) on the knife edge at the end of the large lever for 187.5 kg test load. Add 62.5 kg weight for 250 kg test load; add a 250 kg for 250 kg total load, add a 500 kg weight for 1000 kg test load, and so on for the other test loads up to 3000. 750 kg load may be set up with 187.5, 62.5 and 500 kg weights. Make certain each weight is oriented so the slot is pointing in a different direction than the weight underneath. This limits the ability of the weights to fall off the tester if accidentally bumped or if a test cycle is initiated without a test sample against the indenter



5.3 Load a Test Specimen

Put a test specimen on the anvil and turn the handwheel (21) of the elevating screw until the piece contacts the indenter. Continue turning the handwheel until the indenter is lifted slightly and the handwheel slips.

If the handwheel does not reach a point where it slips, the ball detent (19) may need adjustment. Using a flat head screwdriver unscrew the detent screw by a quarter turn and turn the handwheel. If it does not slip repeat the procedure until it slips.

5.4 Selecting Time-at-load

Turn on the power switch (14) and the power supply light (4A) will turn on. Choose the duration of loading according to the Face Plate Detail on page 8 then push the button for duration loading (12, 30 or 60 seconds).

5.5 Initiating a Test

Push the start button (5A). A test cycle will be completed automatically by the tester.

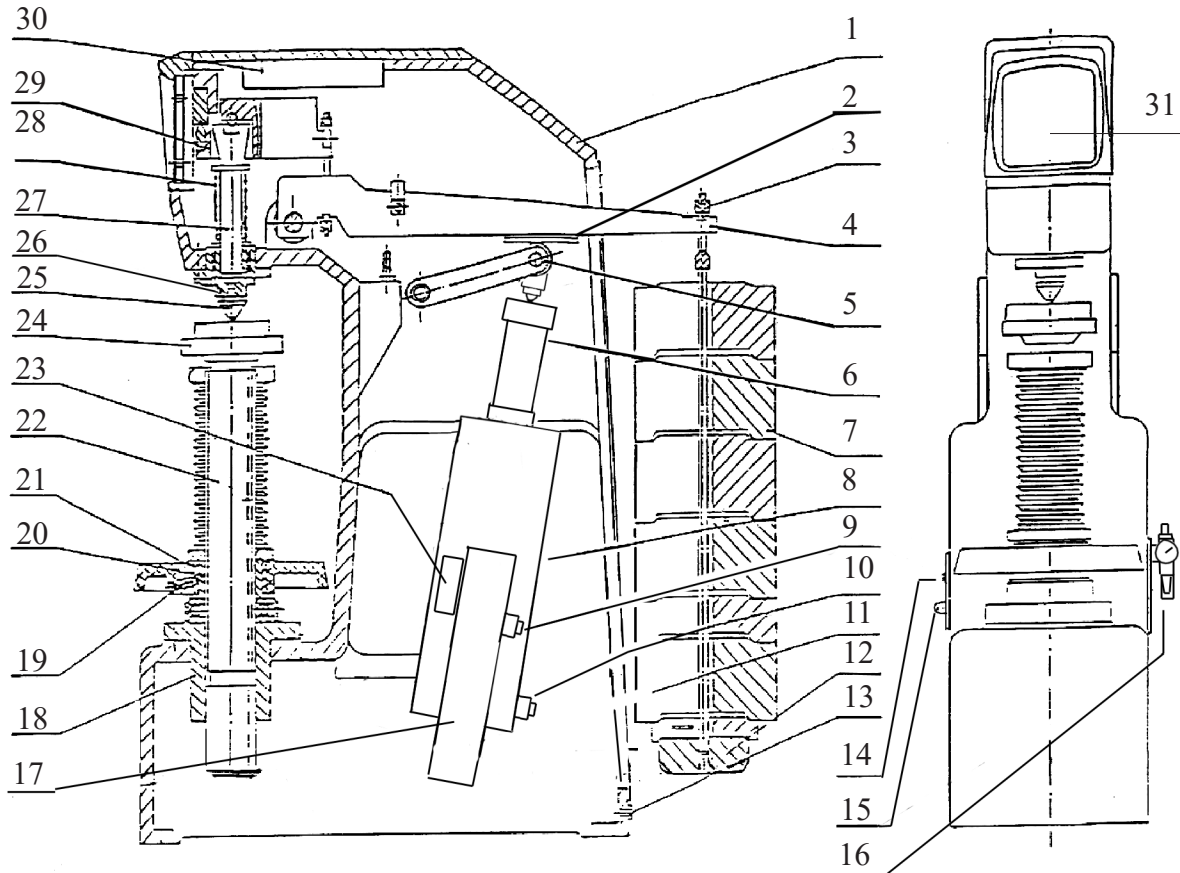
5.6 Test Completion

When the test is over, lower the elevating screw and remove the specimen. Measure the diameter of the impression with a scope and convert the measurement to a Brinell value with a Brinell chart.

5.7 Brinell Scope Measurement

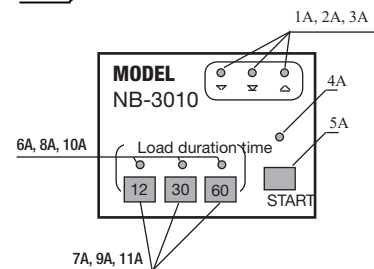
The magnification of a standard measurement scope is 20X. The minimum graduation of the microscope is 0.1mm. A battery-powered light is usually attached.

6. PARTS LOCATION DIAGRAMS



1. Frame
2. Limit Switch
3. Hanger
4. Load Lever
5. Fork Rocker
6. Piston Rod
7. Test Load Weights
8. Pneumatic Cylinder
9. Flow Control Adjustment (down)
10. Flow Control Adjustment (up)
11. Back Cover
12. Base Weight
13. Ground Screw
14. Power Switch
15. Fuse

16. Air Regulator (set to 60 psi)
17. Cylinder Mounting Bracket
18. Elevating Screw Seat
19. Ball detent
20. Nut
21. Handwheel
22. Elevating Screw
23. Solenoid (behind the bracket (17) when viewed through the back cover (11))
24. Anvil
25. Indenter
26. Main Shaft
27. Rod.
28. Spring
29. Small Lever
30. Circuit Board
31. Faceplate (See detail)



FACE PLATE DETAIL

- 1A, 2A, 3A. Light Indicators for Loading, Dwell Time, & Unloading
- 4A. Light Indicator for Power Supply
- 5A. Start Button
- 6A, 8A, 10A. Light Indicators for Load Duration
- 7A, 9A, 11A. Buttons for Load Duration

7. THE BRINELL TEST METHOD

7.1 The ASTM Specification

Brinell testing is covered by the ASTM standard E-10. The ASTM specification can be purchased from the ASTM (American Society for Testing and Materials) at 1916 Race Street, Philadelphia, PA 19103. The following test method is not a complete description of the standard. It provides enough information to perform a test with the NB3010 and get a test result.

7.2 Selecting a Indenter Size and Test Load

The operator must select a indenter ball size. The ball size is most commonly 10mm, but 5 mm, and 2.5mm can also used. (5mm and 2.5mm ball indenters are optionally available from Newage Testing Instruments.) A load must also be selected. Most commonly 3000 kg is used but other loads of 187.5, 250, 500, 750, 1000, and 1500 are also used. The combinations of load and indenter that can be used are as follows:

Hardness Scale	Ball dia. (mm)	Load (kgf)
HBS or HBW 10/3000	10	3000
HBS or HBW 10/1500	10	1500
HBS or HBW 10/1000	10	1000
HBS or HBW 10/500	10	500
HBS or HBW 10/250	10	250
HBS or HBW 5/750	5	750
HBS or HBW 5/250	5	250
HBS or HBW 2.5/187.5	2.5	187.5
HBS or HBW 2.5/62.5	2.5	62.5

NOTE: HBS indicates the use of a hardened steel ball and HBW indicates the use of a Tungsten carbide ball.

The reason various loads exist is that there are a number of conditions that can exist that make it beneficial to use one load over another:

- The material may be too thin or the test portion too close to an edge of the part to use a higher load.
- The surface or surface preparation may be rougher so a larger impression makes for a relatively greater precision in measurement.
- Larger impressions tend to average out discontinuities in hardness inherent in materials with large grain structure.

The conditions that must be adhered to are as follows:

- The impression must be no closer than 2.5 impression diameters to another impression or the edge of the specimen.
- When impressions are made on a curved surface the minimum radius of curvature of the surface must 5 times the diameter of the ball.
- The thickness of the specimen that can be tested is limited to the condition that it should not show any effects of testing on the underside of the test specimen. Generally the test specimen should be 10 times thicker than the impression.

7.3 Other Conditions for Testing

- The angle of test force should be within 90L K2L.
- A hardened steel ball (at least 810 Vickers hardness) may only be used on a material of hardness less than 450 and with a tungsten carbide ball on materials under HB 650.
- The test force should be applied smoothly and for 10 to 15 seconds.
- To improve the ability to measure an impression, the test site is often ground down slightly so a smoother edged, easily measured test impression can be made.

7.4 Measurement of the Brinell Impression & Obtaining a Brinell Value

The impression should be measured with a Brinell scope (usually around 20x power with a fixed measuring scale in millimeters and a source of light to facilitate measurement) at perpendicular axes to within 0.05 mm. The average value is used for calculation of the Brinell value by looking up the Brinell scale (load and indenter size) in the Brinell Conversion Chart. This averaged measurement gives the corresponding hardness value.

All Brinell Values should be reported with the load, ball size, ball material, and time-at-load if it is not the most common 3000kg, 10mm tungsten ball, and 10-15 seconds time-at load. The test result is often abbreviated such as HB5 400 for Hardness Brinell, 500 kg., test value 500.

7.5 Calibration

There are two methods of calibration of the tester: direct and indirect. The direct method should be used for checking a new or rebuilt tester. Indirect calibration should be used for routine checking.

Before a tester is calibrated, it should be checked to make certain that it is set up properly, the indenter assembly is not damaged and a new ball is properly installed, and the test force is applied without shock or vibration.

Direct verification involves direct measurement of the indenter, test load, and scope. Indirect verification involves the use of a standardized test block where testing is done with all the different forces, balls and hardness ranges being used. For information, please refer to the most recent revision of ASTM E-10 available.

Daily calibration is performed by making two impressions on a test block, averaging the values and comparing it with the test block value. If the averaged test value falls within the test block tolerances, then the tester is suitable for testing.

8. MAINTENANCE

1. Check the pressure produced by the handwheel detent periodically, it should overcome the pressure of the spring of rod. Perform the check with weights added to the base weight to prevent the lever from rising. The frequency of checking depends upon the operating conditions.
2. The frictional surfaces of the tester shall be lubricated twice a month.
3. Use the dust cover after testing.
4. Remove the weights and the base weight after test. Fix the lever to prevent it from damage in transportation.
5. Switch off power supply when the tester is not in use or during maintenance.
6. Check the indenter assembly. Clean any oil from the surface of the ball and the ball holder before installing. Spread a little Vaseline on the spherical indentation of the ball holder. Install the steel or tungsten carbide ball, and screw on the indenter cap.
7. Adjust speed of load application and removal, if needed, by opening the back panel and adjusting the up and or down flow controls. (See diagram on Page 8.)

9. CONTACT INFORMATION

Contact this location for general or sales questions as well as self-repair questions, parts, billing etc.

205 Keith Valley Road
Horsham PA 19044, USA
Tel: 215-355-6900
Fax: 215-354-1803
newage.info@ametech.com
www.hardnesstesters.com

To schedule a service call anywhere in North America contact
Newage Testing Instruments Service 317-329-4300

Appendix A: Instructions for Converting NB3010 from Electric to Air

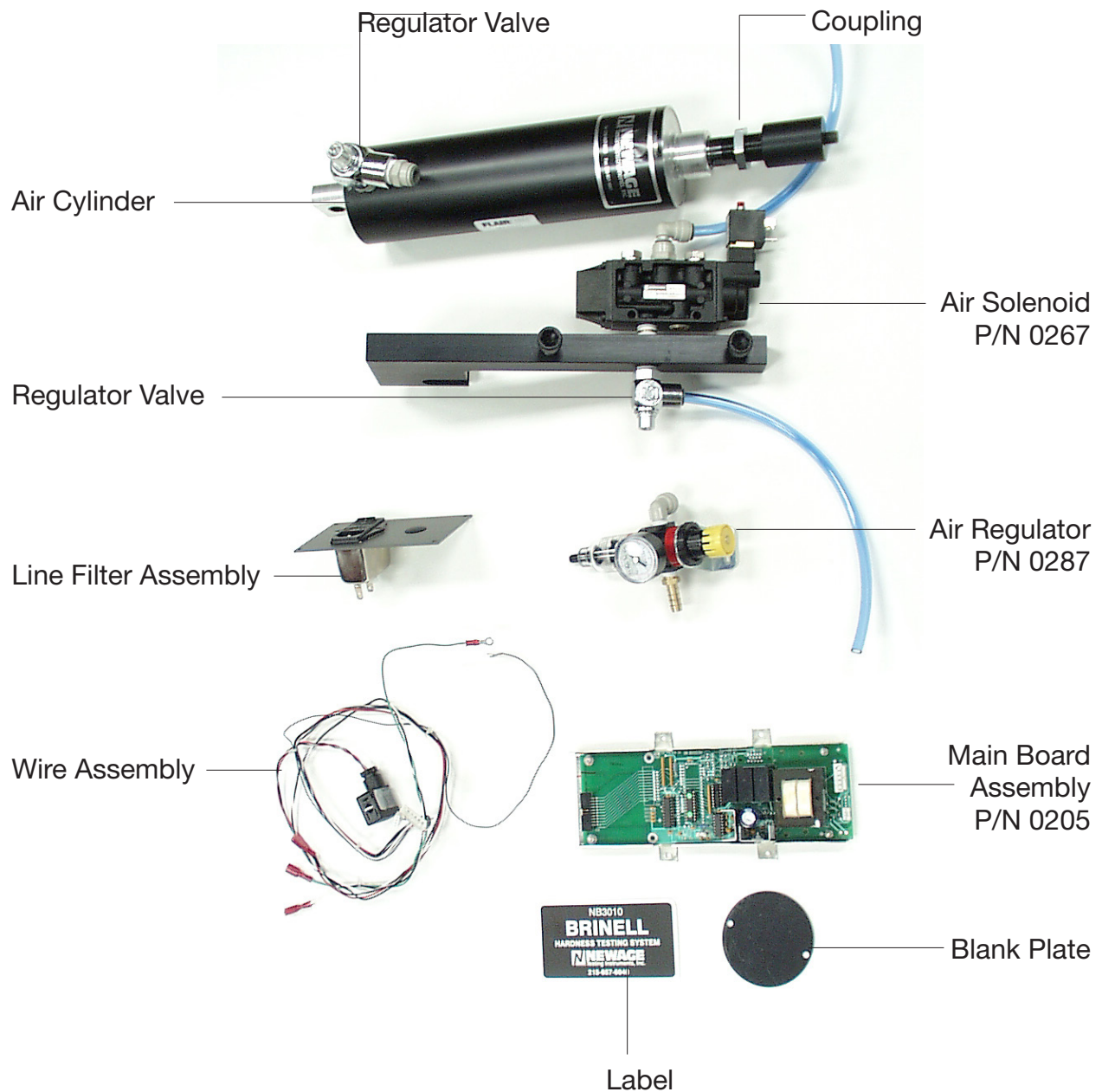


Fig 1: UPGRADE PARTS DIAGRAM

1. Remove motor and gear box. (Refer to Figure 2)
2. Remove the plate on the top of the tester and the circuit board underneath. Remove the connectors with wiring from the back end of the circuit board. (Refer to Figures 3 & 4.)
3. Replace the entire board.
4. Replace two connectors and wiring with new ones supplied.
5. Remove the vents (Figure 6) Using new cable make the connection to the switch and install the line filter plate. Use 8mm socket head screw for ground where gear case was mounted. (Figure 7) Install the blank plate on the vent opening on the side of the tester.
6. Remove coupling from cylinder to install onto rocker arm drag link.
7. Reconnect the connector from the circuit board to the faceplate. Replace the circuit board and the top cover plate.

Figure 2: Motor and gear box removed from stand.

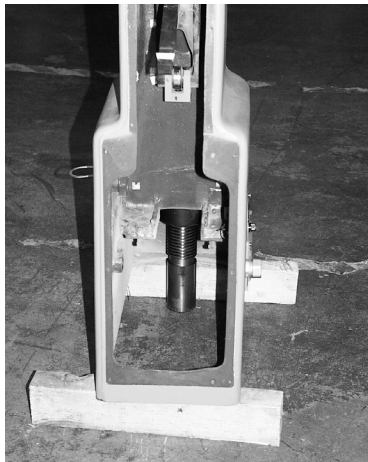


Figure 3: Ribbon cable with connector to faceplate



Figure 4: Electronic circuit board showing connectors and new chip location.

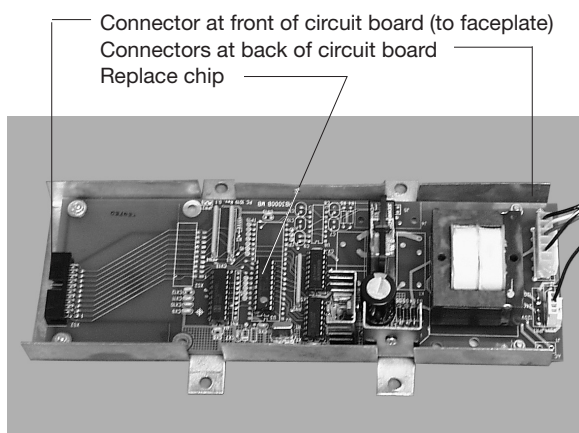
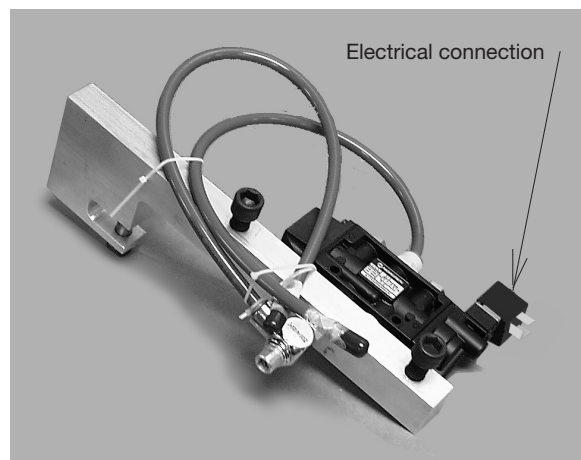


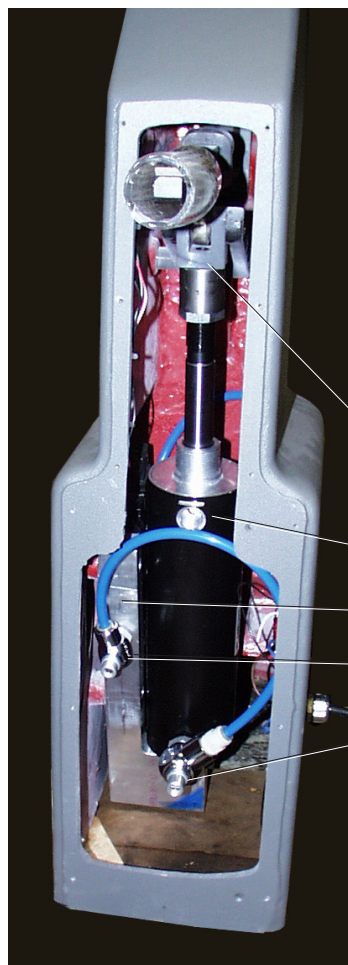
Figure 5: Pneumatic cylinder bracket with electrical connection point



8. Attach the air cylinder to the link on the fork rocker as per Parts Location Diagram and the photo below. Install the air cylinder. Bottom it out, then back it off 4 (four) complete turns. Tighten nut and set screw. Mount the bracket and air cylinder using two bolts from existing motor/gearbox. (Figures 6, 8) Make certain the airline from the solenoid on the bracket is sticking out the bolt hole at the location where the air regulator installs.
9. Attach the airline to the regulator and position the air regulator through the third hole of gear-box (Figure 6). The regulator bracket (Figure 6) should be positioned on the regulator in order to mark the two 10-32 holes which must be tapped to install the bracket. After tapping the holes install the bracket and the regulator.
10. Connect air lines from cylinder bracket to the bottom of the cylinder.
11. Regulate air to 60 psi.

Notes: A) The down speed is adjusted with the flow control attached to the cylinder.
 B) The up speed is adjusted with the flow attached to the bracket.

Figure 8: Back of tester showing pneumatic cylinder link, bracket and installed air cylinder with air connection points.



Regulator bracket
 Bolt holes
 Vent plate
 Link
 Pneumatic Cylinder
 Bracket
 Up Speed Control
 Down Speed control
 Air regulator with support bracket installed (bracket holes must be tapped)
 Power switch

Figure 6: Side of tester showing vent and mounting holes after removal of the motor and gear box.

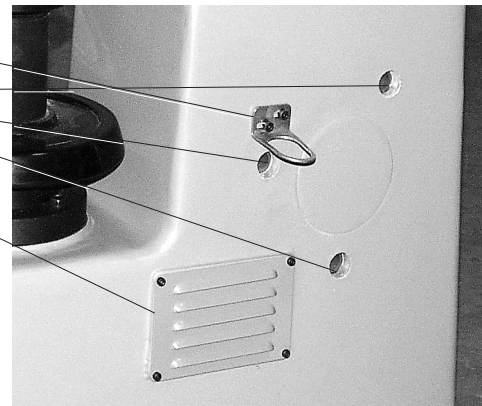


Figure 7: Side of tester showing mounted air regulator and installed switch plate assembly.



Appendix B: Brinell Conversion Charts

Brinell Conversion: Diameter Measurement to Brinell Value Using 10 mm Ball

Diameter (mm)	LOAD (kg)			
	3000	1500	1000	500
3.68	272	136	91	45.4
3.69	271	135	90	45.1
3.70	269	135	90	44.9
3.71	268	134	89	44.6
3.72	266	133	89	44.4
3.73	265	132	88	44.1
3.74	263	132	88	43.9
3.75	262	131	87	43.6
3.76	260	130	87	43.4
3.77	259	129	86	43.1
3.78	257	129	86	42.9
3.79	256	128	85	42.7
3.80	255	127	85	42.4
3.81	253	127	84	42.2
3.82	252	126	84	42.0
3.83	250	125	83	41.7
3.84	249	125	83	41.5
3.85	248	124	83	41.3
3.86	246	123	82	41.1
3.87	245	123	82	40.9
3.88	244	122	81	40.6
3.89	242	121	81	40.4
3.90	241	121	80	40.2
3.91	240	120	80	40.0
3.92	239	119	80	39.8
3.93	237	119	79	39.6
3.94	236	118	79	39.4
3.95	235	117	78	39.1
3.96	234	117	78	38.9
3.97	232	116	77	38.7
3.98	231	116	77	38.5
3.99	230	115	77	38.3
4.00	229	114	76	38.1
4.01	228	114	76	37.9
4.02	226	113	75	37.7
4.03	225	113	75	37.5
4.04	224	112	75	37.3
4.05	223	111	74	37.2
4.06	222	111	74	37.0
4.07	221	110	74	36.8
4.08	219	110	73	36.6
4.09	218	109	73	36.4
4.10	217	109	72	36.2
4.11	216	108	72	36.0
4.12	215	108	72	35.8
4.13	214	107	71	35.7
4.14	213	106	71	35.5
4.15	212	106	71	35.3
4.16	211	105	70	35.1
4.17	210	105	70	34.9
4.18	209	104	70	34.8
4.19	208	104	69	34.6
4.20	207	103	69	34.4
4.21	206	103	69	34.3
4.22	204	102	68	34.1

Diameter (mm)	LOAD (kg)			
	3000	1500	1000	500
4.23	203	102	68	33.9
4.24	202	101	67	33.7
4.25	201	101	67	33.6
4.26	200	100	67	33.4
4.27	199	100	66	33.2
4.28	198	99	66	33.1
4.29	198	99	66	32.9
4.30	197	98	66	32.8
4.31	196	98	65	32.6
4.32	195	97	65	32.4
4.33	194	97	65	32.3
4.34	193	96	64	32.1
4.35	192	96	64	32.0
4.36	191	95	64	31.8
4.37	190	95	63	31.7
4.38	189	95	63	31.5
4.39	188	94	63	31.4
4.40	187	94	62	31.2
4.41	186	93	62	31.1
4.42	185	93	62	30.9
4.43	185	92	62	30.8
4.44	184	92	61	30.6
4.45	183	91	61	30.5
4.46	182	91	61	30.3
4.47	181	91	60	30.2
4.48	180	90	60	30.0
4.49	179	90	60	29.9
4.50	179	89.3	59.5	29.8
4.51	178	88.9	59.2	29.6
4.52	177	88.4	59.0	29.5
4.53	176	88.0	58.7	29.3
4.54	175	87.6	58.4	29.2
4.55	174	87.2	58.1	29.1
4.56	174	86.8	57.9	28.9
4.57	173	86.4	57.6	28.8
4.58	172	86.0	57.3	28.7
4.59	171	85.6	57.1	28.5
4.60	170	85.2	56.8	28.4
4.61	170	84.8	56.5	28.3
4.62	169	84.4	56.3	28.1
4.63	168	84.0	56.0	28.0
4.64	167	83.6	55.8	27.9
4.65	167	83.3	55.5	27.8
4.66	166	82.9	55.3	27.6
4.67	165	82.5	55.0	27.5
4.68	164	82.1	54.8	27.4
4.69	164	81.8	54.5	27.3
4.70	163	81.4	54.3	27.1
4.71	162	81.0	54.0	27.0
4.72	161	80.7	53.8	26.9
4.73	161	80.3	53.5	26.8
4.74	160	79.9	53.3	26.6
4.75	159	79.6	53.0	26.5
4.76	158	79.2	52.8	26.4
4.77	158	78.9	52.6	26.3

Diameter (mm)	LOAD (kg)			
	3000	1500	1000	500
4.78	157	78.5	52.3	26.2
4.79	156	78.2	52.1	26.1
4.80	156	77.8	51.9	25.9
4.81	155	77.5	51.6	25.8
4.82	154	77.1	51.4	25.7
4.83	154	76.8	51.2	25.6
4.84	153	76.4	51.0	25.5
4.85	152	76.1	50.7	25.4
4.86	152	75.8	50.5	25.3
4.87	151	75.4	50.3	25.1
4.88	150	75.1	50.1	25.0
4.89	150	74.8	49.8	24.9
4.90	149	74.4	49.6	24.8
4.91	148	74.1	49.4	24.7
4.92	148	73.8	49.2	24.6
4.93	147	73.5	49.0	24.5
4.94	146	73.2	48.8	24.4
4.95	146	72.8	48.6	24.3
4.96	145	72.5	48.3	24.2
4.97	144	72.2	48.1	24.1
4.98	144	71.9	47.9	24.0
4.99	143	71.6	47.7	23.9
5.00	143	71.3	47.5	23.8
5.01	142	71.0	47.3	23.7
5.02	141	70.7	47.1	23.6
5.03	141	70.4	46.9	23.5
5.04	140	70.1	46.7	23.4
5.05	140	69.8	46.5	23.3
5.06	139	69.5	46.3	23.2
5.07	138	69.2	46.1	23.1
5.08	138	68.9	45.9	23.0
5.09	137	68.6	45.7	22.9
5.10	137	68.3	45.5	22.8
5.11	136	68.0	45.3	22.7
5.12	135	67.7	45.1	22.6
5.13	135	67.4	45.0	22.5
5.14	134	67.2	44.8	22.4
5.15	134	66.9	44.6	22.3
5.16	133	66.6	44.4	22.2
5.17	133	66.3	44.2	22.1
5.18	132	66.0	44.0	22.0
5.19	132	65.8	43.8	21.9
5.20	131	65.5	43.7	21.8
5.21	130	65.2	43.5	21.7
5.22	130	64.9	43.3	21.6
5.23	129	64.7	43.1	21.6
5.24	129	64.4	42.9	21.5
5.25	128	64.1	42.8	21.4
5.26	128	63.9	42.6	21.3
5.27	127	63.6	42.4	21.2
5.28	127	63.3	42.2	21.1
5.29	126	63.1	42.1	21.0
5.30	126	62.8	41.9	20.9
5.31	125	62.6	41.7	20.9
5.32	125	62.3	41.5	20.8

Brinell Conversion: Diameter Measurement to Brinell Value Using 10 mm Ball

Diameter (mm)	LOAD (kg)			
	3000	1500	1000	500
5.33	124	62.1	41.4	20.7
5.34	124	61.8	41.2	20.6
5.35	123	61.6	41.0	20.5
5.36	123	61.3	40.9	20.4
5.37	122	61.1	40.7	20.4
5.38	122	60.8	40.5	20.3
5.39	121	60.6	40.4	20.2
5.40	121	60.3	40.2	20.1
5.41	120	60.1	40.0	20.0
5.42	120	59.8	39.9	19.9
5.43	119	59.6	39.7	19.9
5.44	119	59.3	39.6	19.8
5.45	118	59.1	39.4	19.7
5.46	118	58.9	39.2	19.6
5.47	117	58.6	39.1	19.5
5.48	117	58.4	38.9	19.5
5.49	116	58.2	38.8	19.4
5.50	116	57.9	38.6	19.3
5.51	115	57.7	38.5	19.2
5.52	115	57.5	38.3	19.2
5.53	114	57.2	38.2	19.1
5.54	114	57.0	38.0	19.0
5.55	114	56.8	37.9	18.9
5.56	113	56.6	37.7	18.9
5.57	113	56.3	37.6	18.8
5.58	112	56.1	37.4	18.7
5.59	112	55.9	37.3	18.6
5.60	111	55.7	37.1	18.6
5.61	111	55.5	37.0	18.5
5.62	110	55.2	36.8	18.4
5.63	110	55.0	36.7	18.3
5.64	110	54.8	36.5	18.3
5.65	109	54.6	36.4	18.2
5.66	109	54.4	36.3	18.1
5.67	108	54.2	36.1	18.1
5.68	108	54.0	36.0	18.0
5.69	108	53.8	35.8	17.9
5.70	107	53.5	35.7	17.8
5.71	107	53.3	35.6	17.8
5.72	106	53.1	35.4	17.7
5.73	106	52.9	35.3	17.6
5.74	105	52.7	35.1	17.6
5.75	105	52.5	35.0	17.5
5.76	105	52.3	34.9	17.4
5.77	104	52.1	34.7	17.4
5.78	104	51.9	34.6	17.3
5.79	103	51.7	34.5	17.2
5.80	103	51.5	34.3	17.2
5.81	103	51.3	34.2	17.1
5.82	102	51.1	34.1	17.0
5.83	102	50.9	33.9	17.0
5.84	101	50.7	33.8	16.9
5.85	101	50.5	33.7	16.8
5.86	101	50.3	33.6	16.8
5.87	100	50.2	33.4	16.7
5.88	100	50.0	33.3	16.7

Diameter (mm)	LOAD (kg)			
	3000	1500	1000	500
5.89	100	49.8	33.2	16.6
5.90	99.2	49.6	33.1	16.5
5.91	98.8	49.4	32.9	16.5
5.92	98.4	49.2	32.8	16.4
5.93	98.0	49.0	32.7	16.3
5.94	97.7	48.8	32.6	16.3
5.95	97.3	48.7	32.4	16.2
5.96	96.9	48.5	32.3	16.2
5.97	96.6	48.3	32.2	16.1
5.98	96.2	48.1	32.1	16.0
5.99	95.9	47.9	32.0	16.0
6.00	(95.5)	(47.7)	(31.8)	(15.9)
6.01	(95.1)	(47.6)	(31.7)	(15.9)
6.02	(94.8)	(47.4)	(31.6)	(15.8)
6.03	(94.4)	(47.2)	(31.5)	(15.7)
6.04	(94.1)	(47.0)	(31.4)	(15.7)
6.05	(93.7)	(46.9)	(31.2)	(15.6)
6.06	(93.4)	(46.7)	(31.1)	(15.6)
6.07	(93.0)	(46.5)	(31.0)	(15.5)
6.08	(92.7)	(46.3)	(30.9)	(15.4)
6.09	(92.3)	(46.2)	(30.8)	(15.4)
6.10	(92.0)	(46.0)	(30.7)	(15.3)
6.11	(91.7)	(45.8)	(30.6)	(15.3)
6.12	(91.3)	(45.7)	(30.4)	(15.2)
6.13	(91.0)	(45.5)	(30.3)	(15.2)
6.14	(90.6)	(45.3)	(30.2)	(15.1)
6.15	(90.3)	(45.2)	(30.1)	(15.1)
6.16	(90.0)	(45.0)	(30.0)	(15.0)
6.17	(89.7)	(44.8)	(29.9)	(14.9)
6.18	(89.3)	(44.7)	(29.8)	(14.9)
6.19	(89.0)	(44.5)	(29.7)	(14.8)
6.20	(88.7)	(44.3)	(29.6)	(14.8)
6.21	(88.3)	(44.2)	(29.4)	(14.7)
6.22	(88.0)	(44.0)	(29.3)	(14.7)
6.23	(87.7)	(43.9)	(29.2)	(14.6)
6.24	(87.4)	(43.7)	(29.1)	(14.6)
6.25	(87.1)	(43.5)	(29.0)	(14.5)
6.26	(86.7)	(43.4)	(28.9)	(14.5)
6.27	(86.4)	(43.2)	(28.8)	(14.4)
6.28	(86.1)	(43.1)	(28.7)	(14.4)
6.29	(85.8)	(42.9)	(28.6)	(14.3)
6.30	(85.5)	(42.7)	(28.5)	(14.2)
6.31	(85.2)	(42.6)	(28.4)	(14.2)
6.32	(84.9)	(42.4)	(28.3)	(14.1)
6.33	(84.6)	(42.3)	(28.2)	(14.1)
6.34	(84.3)	(42.1)	(28.1)	(14.0)
6.35	(84.0)	(42.0)	(28.0)	(14.0)
6.36	(83.7)	(41.8)	(27.9)	(13.9)
6.37	(83.4)	(41.7)	(27.8)	(13.9)
6.38	(83.1)	(41.5)	(27.7)	(13.8)
6.39	(82.8)	(41.4)	(27.6)	(13.8)
6.40	(82.5)	(41.2)	(27.5)	(13.7)
6.41	(82.2)	(41.1)	(27.4)	(13.7)
6.42	(81.9)	(40.9)	(27.3)	(13.6)
6.43	(81.6)	(40.8)	(27.2)	(13.6)
6.44	(81.3)	(40.6)	(27.1)	(13.5)

Diameter (mm)	LOAD (kg)			
	3000	1500	1000	500
6.45	(81.0)	(40.5)	(27.0)	(13.5)
6.46	(80.7)	(40.4)	(26.9)	(13.5)
6.47	(80.4)	(40.2)	(26.8)	(13.4)
6.48	(80.1)	(40.1)	(26.7)	(13.4)
6.49	(79.8)	(39.9)	(26.6)	(13.3)
6.50	(79.6)	(39.8)	(26.5)	(13.3)
6.51	(79.3)	(39.6)	(26.4)	(13.2)
6.52	(79.0)	(39.5)	(26.3)	(13.2)
6.53	(78.7)	(39.4)	(26.2)	(13.1)
6.54	(78.4)	(39.2)	(26.1)	(13.1)
6.55	(78.2)	(39.1)	(26.1)	(13.0)
6.56	(77.9)	(38.9)	(26.0)	(13.0)
6.57	(77.6)	(38.8)	(25.9)	(12.9)
6.58	(77.3)	(38.7)	(25.8)	(12.9)
6.59	(77.1)	(38.5)	(25.7)	(12.8)
6.60	(76.8)	(38.4)	(25.6)	(12.8)
6.61	(76.5)	(38.3)	(25.5)	(12.8)
6.62	(76.2)	(38.1)	(25.4)	(12.7)
6.63	(76.0)	(38.0)	(25.3)	(12.7)
6.64	(75.7)	(37.9)	(25.2)	(12.6)
6.65	(75.4)	(37.7)	(25.1)	(12.6)
6.66	(75.2)	(37.6)	(25.1)	(12.5)
6.67	(74.9)	(37.5)	(25.0)	(12.5)
6.68	(74.7)	(37.3)	(24.9)	(12.4)
6.69	(74.4)	(37.2)	(24.8)	(12.4)
6.70	(74.1)	(37.1)	(24.7)	(12.4)
6.71	(73.9)	(36.9)	(24.6)	(12.3)
6.72	(73.6)	(36.8)	(24.5)	(12.3)
6.73	(73.4)	(36.7)	(24.5)	(12.2)
6.74	(73.1)	(36.6)	(24.4)	(12.2)
6.75	(72.8)	(36.4)	(24.3)	(12.1)
6.76	(72.6)	(36.3)	(24.2)	(12.1)
6.77	(72.3)	(36.2)	(24.1)	(12.1)
6.78	(72.1)	(36.0)	(24.0)	(12.0)
6.79	(71.8)	(35.9)	(23.9)	(12.0)
6.80	(71.6)	(35.8)	(23.9)	(11.9)
6.81	(71.3)	(35.7)	(23.8)	(11.9)
6.82	(71.1)	(35.5)	(23.7)	(11.8)
6.83	(70.8)	(35.4)	(23.6)	(11.8)
6.84	(70.6)	(35.3)	(23.5)	(11.8)
6.85	(70.4)	(35.2)	(23.5)	(11.7)
6.86	(70.1)	(35.1)	(23.4)	(11.7)
6.87	(69.9)	(34.9)	(23.3)	(11.6)
6.88	(69.6)	(34.8)	(23.2)	(11.6)
6.89	(69.4)	(34.7)	(23.1)	(11.6)
6.90	(69.2)	(34.6)	(23.1)	(11.5)
6.91	(68.9)	(34.5)	(23.0)	(11.5)
6.92	(68.7)	(34.3)	(22.9)	(11.4)
6.93	(68.4)	(34.2)	(22.8)	(11.4)
6.94	(68.2)	(34.1)	(22.7)	(11.4)
6.95	(68.0)	(34.0)	(22.7)	(11.3)
6.96	(67.7)	(33.9)	(22.6)	(11.3)
6.97	(67.5)	(33.8)	(22.5)	(11.3)
6.98	(67.3)	(33.6)	(22.4)	(11.2)
6.99	(67.0)	(33.5)	(22.3)	(11.2)

Brinell Conversion: Diameter Measurement to Brinell Value Using 5 mm Ball

Diameter (mm)	LOAD (kg)			
	750	250	125	62.5
1.00		315	158	79
1.01		309	154	77
1.02		303	151	76
1.03		297	148	74
1.04		291	146	73
1.05		286	143	71
1.06		280	140	70
1.07		275	137	69
1.08		270	135	67
1.09		265	132	66
1.10		260	130	65
1.11		255	128	64
1.12		251	125	63
1.13		246	123	62
1.14		242	121	60
1.15		237	119	59
1.16		233	117	58
1.17		229	115	57
1.18		225	113	56
1.19		222	111	55
1.20		218	109	54
1.21		214	107	54
1.22		211	105	53
1.23		207	104	52
1.24		204	102	51
1.25		200	100	50
1.26	592	197	99	49
1.27	582	194	97	49
1.28	573	191	96	48
1.29	564	188	94	47
1.30	555	185	93	46
1.31	547	182	91	46
1.32	538	179	90	45
1.33	530	177	88	44
1.34	522	174	87	44
1.35	514	171	86	43
1.36	507	169	84	42
1.37	499	166	83	42
1.38	492	164	82	41
1.39	485	162	81	40
1.40	477	159	80	40
1.41	471	157	78	39
1.42	464	155	77	39
1.43	457	152	76	38
1.44	451	150	75	38
1.45	444	148	74	37
1.46	438	146	73	37
1.47	432	144	72	36
1.48	426	142	71	36
1.49	420	140	70	35
1.50	415	138	69	35
1.51	409	136	68	34.1
1.52	404	135	67	33.6
1.53	398	133	66	33.2
1.54	393	131	65	32.7
1.55	388	129	65	32.3
1.56	383	128	64	31.9
1.57	378	126	63	31.5
1.58	373	124	62	31.1
1.59	368	123	61	30.7
1.60	363	121	61	30.3
1.61	359	120	60	29.9
1.62	354	118	59	29.5
1.63	350	117	58	29.1
1.64	345	115	58	28.8
1.65	341	114	57	28.4
1.66	337	112	56	28.1
1.67	333	111	55	27.7
1.68	329	110	55	27.4
1.69	325	108	54	27.0
1.70	321	107	53	26.7
1.71	317	106	53	26.4
1.72	313	104	52	26.1
1.73	309	103	52	25.8

Diameter (mm)	LOAD (kg)			
	750	250	125	62.5
1.74	306	101.9	50.9	25.5
1.75	302	100.7	50.3	25.2
1.76	298	99.5	49.7	24.9
1.77	295	98.3	49.2	24.6
1.78	292	97.2	48.6	24.3
1.79	288	96.1	48.0	24.0
1.80	285	95.0	47.5	23.7
1.81	282	93.9	46.9	23.5
1.82	278	92.8	46.4	23.2
1.83	275	91.8	45.9	22.9
1.84	272	90.7	45.4	22.7
1.85	269	89.7	44.9	22.4
1.86	266	88.7	44.4	22.2
1.87	263	87.7	43.9	21.9
1.88	260	86.8	43.4	21.7
1.89	257	85.8	42.9	21.5
1.90	255	84.9	42.4	21.2
1.91	252	83.9	42.0	21.0
1.92	249	83.0	41.5	20.8
1.93	246	82.1	41.1	20.5
1.94	244	81.3	40.6	20.3
1.95	241	80.4	40.2	20.1
1.96	239	79.5	39.8	19.9
1.97	236	78.7	39.4	19.7
1.98	234	77.9	38.9	19.5
1.99	231	77.1	38.5	19.3
2.00	229	76.3	38.1	19.1
2.01	226	75.5	37.7	18.9
2.02	224	74.7	37.3	18.7
2.03	222	73.9	37.0	18.5
2.04	219	73.2	36.6	18.3
2.05	217	72.4	36.2	18.1
2.06	215	71.7	35.8	17.9
2.07	213	71.0	35.5	17.7
2.08	211	70.2	35.1	17.6
2.09	209	69.5	34.8	17.4
2.10	207	68.8	34.4	17.2
2.11	204	68.2	34.1	17.0
2.12	202	67.5	33.7	16.9
2.13	200	66.8	33.4	16.7
2.14	198	66.2	33.1	16.5
2.15	197	65.5	32.8	16.4
2.16	195	64.9	32.4	16.2
2.17	193	64.3	32.1	16.1
2.18	191	63.6	31.8	15.9
2.19	189	63.0	31.5	15.8
2.20	187	62.4	31.2	15.6
2.21	185	61.8	30.9	15.5
2.22	184	61.2	30.6	15.3
2.23	182	60.7	30.3	15.2
2.24	180	60.1	30.0	15.0
2.25	179	59.5	29.8	14.9
2.26	177	59.0	29.5	14.7
2.27	175	58.4	29.2	14.6
2.28	174	57.9	28.9	14.5
2.29	172	57.3	28.7	14.3
2.30	170	56.8	28.4	14.2
2.31	169	56.3	28.1	14.1
2.32	167	55.8	27.9	13.9
2.33	166	55.3	27.6	13.8
2.34	164	54.8	27.4	13.7
2.35	163	54.3	27.1	13.6
2.36	161	53.8	26.9	13.4
2.37	160	53.3	26.6	13.3
2.38	158	52.8	26.4	13.2
2.39	157	52.3	26.2	13.1
2.40	156	51.9	25.9	13.0
2.41	154	51.4	25.7	12.9
2.42	153	51.0	25.5	12.7
2.43	152	50.5	25.3	12.6
2.44	150	50.1	25.0	12.5
2.45	149	49.6	24.8	12.4
2.46	148	49.2	24.6	12.3
2.47	146	48.8	24.4	12.2

Diameter (mm)	LOAD (kg)			
	750	250	125	62.5
2.48	145	48.3	24.2	12.1
2.49	144	47.9	24.0	12.0
2.50	143	47.5	23.8	11.9
2.51	141	47.1	23.6	11.8
2.52	140	46.7	23.4	11.7
2.53	139	46.3	23.2	11.6
2.54	138	45.9	23.0	11.5
2.55	137	45.5	22.8	11.4
2.56	135	45.1	22.6	11.3
2.57	134	44.8	22.4	11.2
2.58	133	44.4	22.2	11.1
2.59	132	44.0	22.0	11.0
2.60	131	43.7	21.8	10.9
2.61	130	43.3	21.6	10.8
2.62	129	42.9	21.5	10.7
2.63	128	42.6	21.3	10.6
2.64	127	42.2	21.1	10.6
2.65	126	41.9	20.9	10.5
2.66	125	41.5	20.8	10.4
2.67	124	41.2	20.6	10.3
2.68	123	40.9	20.4	10.2
2.69	122	40.5	20.3	10.1
2.70	121	40.2	20.1	10.1
2.71	120	39.9	19.9	10.0
2.72	119	39.6	19.8	9.9
2.73	118	39.2	19.6	9.8
2.74	117	38.9	19.5	9.7
2.75	116	38.6	19.3	9.7
2.76	115	38.3	19.2	9.6
2.77	114	38.0	19.0	9.5
2.78	113	37.7	18.9	9.4
2.79	112	37.4	18.7	9.4
2.80	111	37.1	18.6	9.3
2.81	110	36.8	18.4	9.2
2.82	110	36.5	18.3	9.1
2.83	109	36.3	18.1	9.1
2.84	108	36.0	18.0	9.0
2.85	107	35.7	17.8	8.9
2.86	106	35.4	17.7	8.9
2.87	105	35.1	17.6	8.8
2.88	105	34.9	17.4	8.7
2.89	104	34.6	17.3	8.7
2.90	103	34.3	17.2	8.6
2.91	102	34.1	17.0	8.5
2.92	101	33.8	16.9	8.5
2.93	101	33.6	16.8	8.4
2.94	100	33.3	16.7	8.3
2.95	99.2	33.1	16.5	8.3
2.96	98.4	32.8	16.4	8.2
2.97	97.7	32.6	16.3	8.1
2.98	96.9	32.3	16.2	8.1
2.99	96.2	32.1	16.0	8.0
3.00	95.5	31.8	15.9	8.0
3.01	94.8	31.6	15.8	7.9
3.02	94.1	31.4	15.7	7.8
3.03	93.4	31.1	15.6	7.8
3.04	92.7	30.9	15.4	7.7
3.05	92.0	30.7	15.3	7.7
3.06	91.3	30.4	15.2	7.6
3.07	90.6	30.2	15.1	7.6
3.08	90.0	30.0	15.0	7.5
3.09	89.3	29.8	14.9	7.4
3.10	88.7	29.6	14.8	7.4
3.11	88.0	29.3	14.7	7.3
3.12	87.4	29.1	14.6	7.3
3.13	86.7	28.9	14.5	7.2
3.14	86.1	28.7	14.4	7.2
3.15	85.5	28.5	14.2	7.1
3.16	84.9	28.3	14.1	7.1
3.17	84.3	28.1	14.0	7.0
3.18	83.7	27.9	13.9	7.0
3.19	83.1	27.7	13.8	6.9
3.20	82.5	27.5	13.7	6.9

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





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