



OPERATOR'S MANUAL

Ames

Portable Hardness Testers

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Ames Precision Portable Hardness Tester

OPERATOR'S MANUAL

The Ames Precision Hardness Tester is a hand-held, manually-operated instrument used to perform superficial or standard Rockwell Hardness Tests in the field or laboratory.

Features:

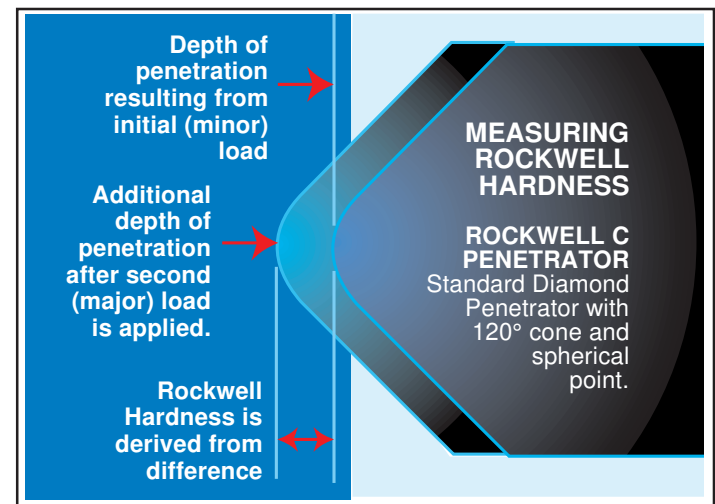
- **Accurate** – providing true Rockwell tests with accuracy to ± 1 point
- **Reliable** – provides years of service when properly maintained and calibrated
- **Versatile** – a variety of models to cover varying needs – plus reversible anvil/penetrator orientation to allow internal surface testing

IMPORTANT: Your tester has been marked with month and year as a reminder to send the instrument in for calibration.



Maintaining your Ames Hardness Tester

All Ames testers are factory lubricated. Do not attempt additional lubrication. Keep the tester dry and free from oil. Store in the case provided. When necessary, wipe with a commercial cleaner.



Hardness Testing – Rockwell scales

Rockwell Hardness testing is a system for determining the hardness of metals and alloys of all kinds. The American Society for Testing and Materials (ASTM) has established a standard recognized worldwide to help manufacturers maintain the qualities they want in their products. ASTM Standards E-18 and E-110 defines the test method and parameters for a valid test using portable hardness testers. Following is a general description of the method.

A spheroconical diamond penetrator or a carbide ball penetrator is forced into the surface being tested at a predetermined pressure load. The hardness is read as a function of the depth of penetration.

To overcome errors in measurement, two pressure loads are applied in

sequence. The first, a minor load is applied and the readout dial is "zeroed" with the part being tested still under load. Then the major load is applied.

The penetrator is backed out to the minor load point to read the distance traveled. The hardness reading represents the additional depth of penetration beyond the minor load.

Tester accuracy is checked by running the test on specimens whose hardness has been certified by an independent testing laboratory.

All Ames hardness testers perform genuine Rockwell Hardness tests, giving a direct Rockwell reading. Their accuracy meets or exceeds ASTM Standards E-18 and E-110. Each tester comes complete with test specimens to assure continued accuracy.

Using Ames testers

Select the penetrator and test block.

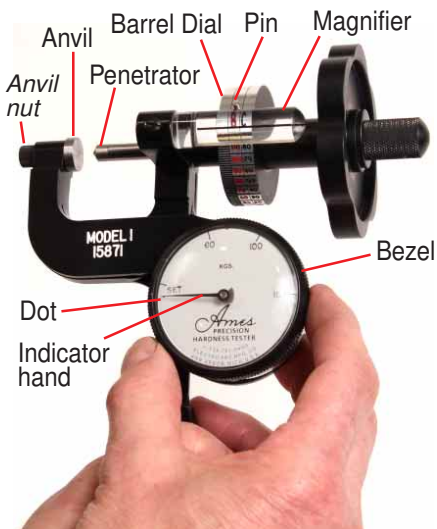
Soft materials are usually tested in the Rockwell B Scale, using 1/16" ball penetrator and 100 kg major load. Hardened steel and hard alloys are tested in the Rockwell C Scale, using a diamond penetrator and a 150 kg major load. The chart below gives some basic guidelines for scales and penetrators.

Set up the tester.

Secure the appropriate penetrator and anvil in the tester. (Refer to chart below or additional chart provided with this manual.)

Step 1

Before putting your specimen into the tester, check the position of the indicator hand. It should rest directly on the dot on the indicator dial. If it doesn't, adjust the dial by turning the bezel to locate the dot under the pointer.



Step 2. Apply Minor Load

Capture your test specimen between the anvil and penetrator. Make sure the penetrator point is not close to the mark of a previous test (see page 6). **Slowly** turn the hand wheel to bring the indicator hand to the line marked "SET." This applies the minor pressure load to the penetrator.

Frequently used scales on Ames Tester Models

See chart provided for other scales

Scale	Minor Load	Major Load	Penetrator
A	10 kg	60 kg	Diamond
B	10 kg	100 kg	1/16" Ball
C	10 kg	150 kg	Diamond
E	10 kg	100 kg	1/8" Ball

Superficial Models:

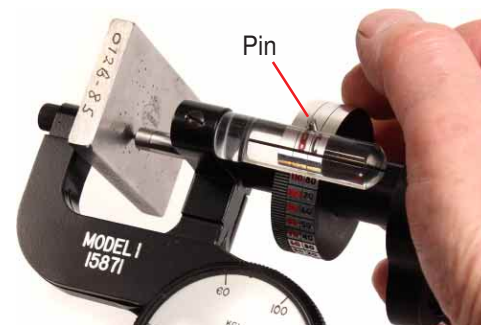
15-N	3 kg	15 kg	Diamond
30-N	3 kg	30 kg	Diamond
45-N	3 kg	45 kg	Diamond
15-T	3 kg	15 kg	1/16" Ball
30-T	3 kg	30kg	1/16" Ball
45-T	3 kg	45 kg	1/16" Ball

Measuring Rockwell Hardness

Step 3: Set the Barrel Dial

Rotate the barrel dial until its pin rests against the upper edge of the lucite magnifier. The upper line of the barrel's hardness scales should be exactly aligned beneath the hairline on the magnifier.

(NOTE: Model 1-4 has no pin, and must be aligned visually.)



Step 4: Apply Major Load.

Turn the hand wheel **only** until the dial pointer rests **exactly** on the major load. **ACCURACY:** your tester is guaranteed to +/- 1 point Rockwell. When using this tester, you must use extreme care to position the pointer exactly on the minor and major load marks.

Rotate handwheel slowly to seat sample, then slowly again until target load is reached.



Shown here is a major load of 150 kg being applied for reading in the Rockwell C scale. With Ames Superficial tester models, the gauge shows 15, 30 and 45 kg pressures and indicates in the Rockwell N and T scales.

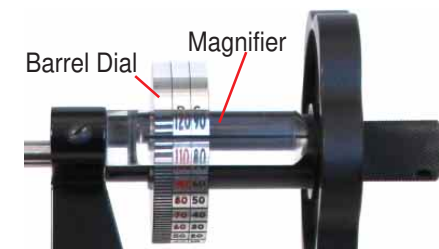
Step 5: Take the reading

Turn the hand wheel back to bring the indicator hand back to "SET" and take the reading on the barrel dial looking through the lucite magnifier. Each graduation on the barrel dial indicates two points in the Rockwell scale.

Standard Tester:

With the diamond penetrator, read Column C on the barrel dial (black numbers).

With the ball penetrator, read Column B (red numbers).



Superficial Tester:

With either the diamond or ball penetrator, take your reading from the black-numbered N-T column on the barrel dial. (The difference in reading is created by the difference in penetrators: N with diamond, T with 1/16" ball.)

Using Tester Accessories

Changing penetrator/anvil

Make sure to tighten it securely. (Hint: take a "dry run" reading to seat the penetrator and/or the anvil before taking an actual reading.)

Anvils

Use the flat anvil for work where the surfaces are parallel. Use the 'V' anvil to hold round stock and the raised flat anvil for irregular surfaces. Make sure to tighten it securely.

Extensions

Models with jaw openings larger than 1" come with jaw opening extensions to allow testing of samples in the 0-1" thickness range. Insert the extension between the anvil and the open end of the jaw. Be sure to tighten it securely.

NOTE: The first two or three tests may be low, until the penetrator and anvil have become firmly seated.

Maintaining accuracy

All AMES Hardness Testers, whether in constant use or not, require accuracy checks. To check accuracy, take the average of 5 readings on the test block. The readings on the barrel dial should agree with the marking on the test block, within +/- 1 point.

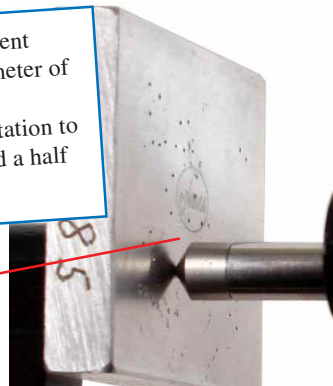
Further, to guarantee the accuracy of your tester, it is recommended that tests be made in high, medium, and low ranges. For example, C Scale, C-63, C-50, and C-28.

Once per year, your tester needs to be factory calibrated.

ASTM Standard E-18 (for testing Rockwell Hardness) says, in part:

- 7.9 The distance between the center of two adjacent indentations shall be at least three times the diameter of the indentation.
7.9.1 The distance from the center of any indentation to an edge of the test piece shall be at least two and a half times the diameter of the indentation.

In other words, keep indentations 3 diameters apart. Indentations can only be made on one side of the test block.



Special Testers: Model 8

The Model 8 Tester is affixed to the stock piece by means of a large "C" clamp which has a screw long enough to hold anything from about 1/4" thick up to 8" in diameter.

The anvil of the screw has a ball socket which automatically aligns the penetrator spindle at a right angle to the workpiece. This allows testing diameters up to 8" as well as flat or irregular pieces without changing the setup.

Caution: the Penetrator of Model 8 comes through a hole in the anvil. If it is extended while clamping or unclamping the tester to/from the workpiece, it is almost certain to be damaged. Be sure to make sure the penetrator is retracted before clamping or unclamping the workpiece.

Anvils

There are two anvils supplied specifically for this tester: Flat and V-shaped. They are secured in the measuring head by a spring-loaded ball and can be changed by simply pulling one out and inserting the other.

Each has a hole to accommodate the penetrator. When changing from the flat to the "V," the penetrator must be retracted further to avoid contacting the workpiece prematurely.

Use the flat anvil with the test blocks or other flat stock; the "V" with round stock.

Setup

When applying the instrument to the stock piece, take care not to allow the penetrator to strike the stock piece.

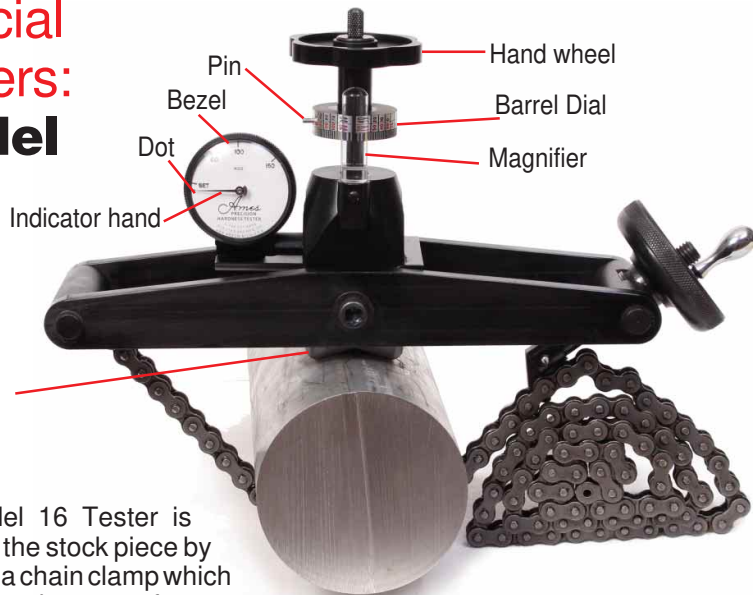
Once the tester is aligned and fastened to the stock piece, tighten the screw so that the pressure exerted is greater than the maximum pressure in any Rockwell test.

Making Hardness Tests

Follow the same procedure for minor load, major load and reading as for all standard Ames Testers (pages 4-5).



Special Testers: Model 16



The Model 16 Tester is affixed to the stock piece by means of a chain clamp which can secure the tester frame to anything from about 4" thick up to 16" in diameter.

The measuring head is independent of the clamp and may be removed for mounting on a holder of your own design.

Caution: the Penetrator of Model 16 comes through a hole in the anvil. If it is extended while clamping the tester to the workpiece, it is almost certain to be damaged. Be sure to make sure the retractor is retracted before clamping or unclamping the workpiece.

Anvils

There are two anvils supplied specifically for this tester: Flat and "V"-shaped. They are secured in the measuring head by a spring-loaded ball and can be changed by simply pulling one out and inserting the other.

Each has a hole to accommodate the penetrator. When changing from the flat to the "V," the penetrator must be retracted further to avoid contacting the workpiece prematurely.

Setup

When applying the instrument to the stock piece, take care not to allow the penetrator to strike the stock piece.

Once the tester is aligned and fastened to the stock piece, tighten the screw so that the pressure exerted is greater than the maximum pressure in any Rockwell test.

Making Hardness Tests

Follow the same procedure for minor load, major load and reading as for all standard Ames Testers (pages 4-5).

Ames Portable Hardness Tester Accessories

Anvils

The correct anvil helps you get the reading right the first time.



V ANVIL

1/2" #T1128
1" #T2228
1-1/4" #T4228



CYLINDRICAL

1/2" #T1126
3/4" #T2226
1" #T4226



CONVEX ANVIL

1/2" #T1127
3/4" #T2227
1" #T4227



RAISED FLAT

1/8" #T1130
1/4" #T1129



FLAT ANVIL

1/2" #T1125
1" #T4225



Penetrators

1/16" Ball #AT1257
1/8" Ball #AT1259
1/4" Ball #AT1160
1/2" Ball #AT1162



Diamond Penetrators

Standard #T1131
Superficial #T1178



Extensions

Extensions allow testing thinner items with larger tester models without sacrificing stability.

3/4" (3/8" dia.) T1132
1/2" T2232
3/4" T4232
1" T4234
2" T4235



Certified Test Blocks

Hard Steel (C Scale) #T1233
Soft Steel (C Scale) #T1234
Brass (B Scale) #T1241

Bench Stand

Holds tester securely for hands free operation. Tester is inclined at a convenient angle and rigidly supported. Internal fibre sleeve protects tester's grip.

Weight: 11 lbs.

Part #AT1142



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TABLE II
CORRECTIONS TO BE ADDED TO ROCKWELL C, A, AND D, VALUES
OBTAINED ON CYLINDRICAL SPECIMENS OF VARIOUS DIAMETERS.

Dial Readings	1/4 in.	3/8 in.	1/2 in.	5/8 in.	3/4 in.	7/8 in.	1 in.	1-1/4 in.	1-1/2 in.
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	1.5	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

CORRECTION CHARTS

TABLE III
CORRECTIONS TO BE ADDED TO ROCKWELL 15N, 30N, AND 45N
VALUES OBTAINED ON CYLINDRICAL SPECIMENS OF VARIOUS DIAMETERS.

Dial Readings	1/8 in.	1/4 in.	3/8 in.	1/2 in.	3/4 in.	1 in.
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	1.5	1.0
35	5.0	2.5	2.0	1.5	1.5	1.0
40	4.5	2.5	1.5	1.5	1.5	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	1.0
0.5						
55	3.5	2.0	1.5	1.0	1.0	0.5
60	3.0	1.5	1.0	1.0	1.0	0.5
65	2.5	1.5	1.0	0.5	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

CORRECTION CHARTS

CONVERSION CHART FOR AMES PORTABLE HARDNESS TESTER

Hardened Steel, Hard Alloys							Soft Steel, Non-Ferrous Metal, Gray & Malleable Iron Casting														
D I A M O N D P E N E T R A T O R 150 kg. LOAD	D I A M O N D P E N E T R A T O R 60 kg. LOAD	D I A M O N D P E N E T R A T O R 100 kg. LOAD	10 M.M. BALL 3 0 0 0 K g .	D I A M O N D P E N E T R A T O R 15 kg. LOAD	D I A M O N D P E N E T R A T O R 30 kg. LOAD	D I A M O N D P E N E T R A T O R 45 kg. LOAD	1/16" BALL 100 kg. LOAD	1/8" BALL 100 kg. LOAD	1/16" BALL 60 kg. LOAD	1/16" BALL 150 kg. LOAD	10 M.M. BALL 3 0 0 0 K g .	1/16" BALL 15 kg. LOAD	1/16" BALL 30 kg. LOAD	1/16" BALL 45 kg. LOAD	1/16" BALL 100 kg. LOAD	1/8" BALL 100 kg. LOAD	1/16" BALL 60 kg. LOAD	10 M.M. BALL 5 0 0 K g .	1/16" BALL 15 kg. LOAD	1/16" BALL 30 kg. LOAD	1/16" BALL 45 kg. LOAD
C	A ROCKWELL SCALE	D	B R I - N E L L	15-N	30-N	45-N	B	E	F	G	B R I - N E L L	15-T	30-T	45-T	B	E	F	B R I - N E L L	15-T	30-T	45-T
80	92.0	86.5		97.0	92.0	87.0	100	114.5	114.0	82.0	242	93.0	82.0	72.0	50	89.0	86.0	93	77.0	49.5	23.0
79	91.5	85.5		96.5	91.5	86.5	99	114.0	113.5	80.0	235	92.5	81.5	71.0	49	88.5	85.5	92	76.5	49.0	22.0
78	91.0	84.5		-	91.0	85.5	98	113.5	112.5	78.5	228	92.0	81.0	70.0	48	88.0	85.0	90	76.0	48.5	20.5
77	90.5	84.0		96.0	90.5	84.5	97	113.0	112.0	77.0	222	92.0	80.5	69.0	47	87.0	84.5	88	76.0	47.5	19.5
76	90.0	83.5		--	90.0	83.5	96	112.5	111.5	75.5	216	91.5	80.0	68.0	46	86.5	84.0	87	75.5	47.0	18.5
75	89.5	83.0		95.5	89.0	82.5	95	112.0	111.0	74.0	210	91.5	79.0	67.0	45	86.0	83.5	86	75.0	46.0	17.5
74	89.0	82.0		--	88.5	81.5	94	111.5	110.5	72.0	205	91.0	78.5	66.0	44	85.5	83.0	85	75.0	45.5	16.5
73	88.5	81.0		95.0	88.0	80.5	93	111.0	110.0	70.0	200	91.0	78.0	65.5	43	85.0	82.5	83	74.5	45.0	15.5
72	88.0	80.5		94.5	87.0	79.5	92	110.5	109.5	68.5	195	90.5	77.5	64.5	42	84.5	82.0	82	74.0	44.0	14.5
71	87.5	79.5		--	86.5	78.5	91	110.0	109.0	67.0	190	90.5	77.0	63.5	41	84.0	81.5	81	74.0	43.5	13.5
70	87.0	79.0		94.0	86.0	77.5	90	109.5	108.5	65.5	185	90.0	76.0	62.5	40	83.0	81.0	80	73.5	43.0	12.5
69	86.5	78.0		93.5	85.0	76.5	89	109.0	108.0	64.0	179	89.5	75.5	61.5	39	82.5	80.0	79	73.0	42.0	11.0
68	86.0	77.5		--	84.5	75.5	88	108.5	107.5	62.0	176	89.0	75.0	60.5	38	82.0	79.5	78	73.0	41.5	10.0
67	85.5	76.5		93.0	83.5	74.5	87	108.0	107.0	60.0	172	89.0	74.5	59.5	37	81.0	79.0	77	72.5	40.5	9.0
66	85.0	75.5		--	83.0	73.0	86	107.5	106.0	58.5	169	88.5	74.0	58.5	36	80.5	78.5	76	72.0	40.0	8.0
65	84.5	75.0	690	92.0	82.0	72.0	85	107.0	105.5	57.0	165	88.0	73.5	58.0	35	80.0	78.0	75	72.0	39.5	7.0
64	83.5	74.0	673	91.5	81.0	71.0	84	106.5	105.0	55.0	162	88.0	73.0	57.0	34	79.5	77.5	75	71.5	38.5	6.0
63	83.0	73.0	658	91.5	80.0	70.0	83	106.0	104.5	53.5	159	87.5	72.0	56.0	33	79.0	77.0	74	71.0	38.0	5.0
62	82.5	72.5	645	91.0	79.0	69.0	82	105.5	104.0	52.0	156	87.0	71.5	55.0	32	78.0	76.0	74	71.0	37.5	4.0
61	82.0	72.0	628	90.5	78.5	67.5	81	105.0	103.5	50.0	153	87.0	71.0	54.0	31	77.5	75.5	73	70.5	36.5	3.0
60	81.5	71.0	614	90.0	77.5	66.5	80	104.5	103.0	48.5	150	86.5	70.0	53.0	30	77.0	75.0	72	70.5	36.0	2.0
59	81.0	70.5	600	89.5	76.5	65.5	79	104.0	102.0	47.0	147	86.0	69.5	52.0	29	76.5	74.5	71	70.0	35.5	1.0
58	80.5	69.5	587	89.0	75.5	64.0	78	103.5	101.5	45.5	144	86.0	69.0	51.0	28	76.0	74.0	71	69.5	34.5	
57	80.0	69.0	573	89.0	75.0	63.0	77	103.0	101.0	43.5	141	85.5	68.0	50.0	27	75.0	73.5	70	69.5	34.0	

56	79.5	68.0	560	88.5	74.0	62.0	76	102.5	100.5	42.0	139	85.0	67.5	49.0	26	74.5	73.0	69	69.0	33.0	
55	79.0	67.0	547	88.0	73.0	61.0	75	102.0	100.0	40.5	137	85.0	67.0	48.5	25	73.5	72.5	68	68.5	32.5	
54	78.5	66.5	534	87.5	72.0	59.5	74	101.5	99.5	38.5	135	84.5	66.0	47.5	24	73.0	72.0	67	68.5	32.0	
53	78.0	65.5	522	87.0	71.0	58.5	73	101.0	99.0	37.0	132	84.5	65.5	46.5	23	72.0	71.5	66	68.0	31.0	
52	77.5	65.0	509	86.5	70.5	57.5	72	100.5	98.5	35.5	130	84.0	65.0	45.5	22	71.5	71.0	66	67.5	30.5	
51	77.0	64.0	496	86.0	69.5	56.0	71	100.0	98.0	33.5	127	83.5	64.0	44.5	21	71.0	70.0	65	67.5	29.5	
50	76.5	63.5	484	85.5	68.5	55.0	70	99.5	97.5	32.0	125	83.5	63.5	43.5	20	70.0	69.5	65	67.0	29.0	
49	76.0	62.5	472	85.0	67.5	54.0	69	99.0	97.0	30.5	123	83.0	62.5	42.5	19	69.0	69.0	64	67.0	28.5	
48	75.5	62.0	460	84.5	66.5	52.5	68	98.5	96.0	28.5	121	82.5	62.0	41.5	18	68.5	68.5	64	66.5	27.5	
47	75.0	61.0	448	84.0	66.0	51.5	67	98.0	95.5	27.0	119	82.5	61.5	40.5	17	68.0	68.0	63	66.0	27.0	
46	74.5	60.5	437	83.5	65.0	50.0	66	97.5	95.0	25.5	117	82.0	60.5	39.5	16	67.0	67.5	63	66.0	26.0	
45	74.0	59.5	426	83.0	64.0	49.0	65	97.0	94.5	24.0	116	81.5	60.0	38.5	15	66.5	67.0	62	65.5	25.5	
44	73.5	59.0	415	82.5	63.0	48.0	64	96.5	94.0	22.0	114	81.5	59.5	37.5	14	66.0	66.5	62	65.0	25.0	
43	73.0	58.0	404	82.0	62.0	46.5	63	96.0	93.5	20.5	112	81.0	58.5	36.5	13	65.0	66.0	62	65.0	24.0	
42	72.5	57.5	393	81.5	61.5	45.5	62	95.5	93.0	19.0	110	80.5	58.0	35.5	12	64.5	65.0	61	64.5	23.5	
41	72.0	56.5	382	81.0	60.5	44.5	61	95.0	92.5	17.5	108	80.5	57.0	34.5	11	64.0	64.5	61	64.0	23.0	
40	71.5	56.0	372	80.5	59.5	43.0	60	94.5	92.0	16.0	107	80.0	56.5	33.5	10	63.0	64.0	60	64.0	22.0	
39	71.0	55.0	362	80.0	58.5	42.0	59	94.0	91.0	14.0	106	80.0	56.0	32.0	9	62.0	63.5	60	63.5	21.5	
38	70.5	54.5	352	79.5	57.5	41.0	58	93.5	90.5	12.5	104	79.5	55.0	31.0	8	61.5	63.0	59	63.5	20.5	
37	70.0	53.5	342	79.0	56.5	39.5	57	93.0	90.0	11.0	103	79.0	54.5	30.0	7	61.0	62.5	59	63.0	20.0	
36	69.5	53.0	333	78.5	56.0	38.5	56	92.5	89.5	9.5	101	79.0	54.0	29.0	6	60.0	62.0	58	62.5	19.5	
35	69.0	52.0	322	78.0	55.0	37.0	55	92.0	89.0	8.0	100	78.5	53.0	28.0	5	59.5	61.5	58	62.5	18.5	
34	68.0	51.5	313	77.0	54.0	36.0	54	91.0	88.5	6.0	98	78.0	52.5	27.0	4	58.5	60.5	58	62.0	18.0	
33	67.5	50.5	305	76.5	53.0	35.0	53	90.5	88.0	4.5	97	78.0	51.5	26.0	3	58.0	60.0	58	61.5	17.0	
32	67.0	50.0	296	76.0	52.0	33.5	52	90.0	87.0	2.5	96	77.5	51.0	25.0	2	57.5	59.5	57	61.5	16.5	
31	66.5	49.0	290	75.5	51.5	32.5	51	89.5	86.5	1.0	95	77.0	50.5	24.0	1	56.5	59.0	57	61.0	16.0	
30	66.0	48.5	283	75.0	50.5	31.5															
29	65.5	47.5	276	74.5	49.5	30.0															
28	65.0	47.0	272	74.0	48.5	29.0															
27	64.5	46.0	265	73.5	47.5	28.0															
26	64.0	45.5	260	72.5	47.0	26.5															
25	63.5	44.5	255	72.0	46.0	25.5															
24	63.0	44.0	248	71.5	45.0	24.0															
23	62.5	43.0	245	71.0	44.0	23.0															
22	62.0	42.0	240	70.5	43.0	22.0															
21	61.5	41.5	235	70.0	42.5	20.5															
20	61.0	41.0	230	69.5	41.5	19.5															

ROCKWELL-BRINELL CONVERSION TABLE
These conversion tables of Rockwell & equivalent Brinell hardness numbers show the relationship between standard Brinell hardness numbers and the several Rockwell scales including normal as well as superficial types. The latter are for testing thin sheet, light carburized steel, etc. Conversion tables pertaining to hardness can only be approximate. The U.S. Bureau of Standards has established formulas for determining the approximate relationship between Rockwell and Brinell scales.

CHOOSING HARDNESS SCALES

MATERIAL TO BE TESTED	PENETRATOR	SCALE	MAJOR LOAD (kg)	BARREL DIAL
Extremely hard materials, tungsten carbide, thin steel low case hardened steel	Diamond	A	60	C
Medium hard materials, low and medium hardened steels, brass, bronze, aluminum alloys, malleable iron, etc.	1/16" ball	B	100	B
Hardened steels, hardened and tempered alloys, hard cast iron, pearlitic malleable iron, titanium and other materials harder than B100	Diamond	C	150	C
Medium case hardened steel, thin steel, and pearlitic malleable iron	Diamond	D	100	C
Cast iron, aluminum and magnesium alloy bearing metals	1/8" ball	E	100	B
Annealed brass and copper alloys; thin soft sheet metals	1/16" ball	F	60	B

MATERIAL TO BE TESTED	PENETRATOR	SCALE	MAJOR LOAD (kg)	BARREL DIAL
Beryllium copper, phosphor bronze, malleable irons, etc.	1/16" ball	G	150	B
Aluminum sheet, zinc, lead	1/8" ball	H	60	B
Cast iron, aluminum alloys, bearing materials	1/8" ball	K	150	B
Plastics; thin materials, soft metals such as lead	1/4" ball	L	60	B
	1/4" ball	M	100	B
	1/4" ball	P	150	B
	1/2" ball	R	60	B
	1/2" ball	S	100	B
	1/2" ball	V	150	B
Hardened steels, shallow case hardened steels, hardened strip steels down to about .006 thick or where minimum surface distortion is desirable.	Diamond	15N	15	N
	Diamond	30N	30	N
	Diamond	45N	45	N
Soft steels, copper and aluminum alloys, etc., or where minimum surface distortion is desirable.	1/16" ball	15T	15	T
	1/16" ball	45T	45	T