THE IMPRESSOR

HAND HELD PORTABLE HARDNESS TESTER

INSTRUCTION MANUAL

HT-10

AMTAST USA INC

Portable Impressor Hardness Tester Quick User Guide

1. Check the impressor in 0 position (+-1 is acceptable)
2. Specimen thickness must be more than 1.5mm, surface flat and clean.
3. Hold the impressor and put it on the specimen stably (suggest test on plain steel sheet or glass board surface). Apply the test force stably and promptly, read the max reading on the dial.
4. Can test specimen different position to average the results.

USER'S MANUAL

Barcol Impressor

1. Introduction

Barcol Impressor is a kind of indention hardness tester originally made in the USA. It has 3 models in series. HT-10 is the typical model which is in widest application.

Barcol Impressor is mainly applied in two areas: One is Aluminum fabrication industry, to test pure Aluminum, soft Aluminum alloys, thick Aluminum alloys, Aluminum belts, and Aluminum alloys extrusions, bars, castings, forgings and assembled Aluminum alloys parts (e.g. al-alloy door &window, curtain wall etc.) Relevant standard is American standard ASTM B648-00 (Test Method for Indentation Hardness of Aluminum Alloys by Means of a Barcol Impressor); the other is Fiber Reinforced Plastics industry, most domestic and abroad Fiber Reinforced Plastics products are required to test Barcol hardness. Relevant Standard is American standard ASTM D2583-07(Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor) As a measuring instrument, Barcol Impressor has its relevant verification regulation JJG-1989 (Barcol Impressor). This regulation is used for verification of Barcol Impressor newly manufactured, under used and after maintenance.

Barcol Impressor is smart and portable. It can be used by single hand operation, no operating experience required, can test any workpiece which is reachable in any site.

Barcol Impressor has following features: Wide valid testing range equivalent to Brinell hardness 25-150HBW. Used to test the hardness of all kinds of Aluminum, from very soft Aluminum to very hard Aluminum alloys. Extended application. Model 934-1 is applied to test the hardness of Aluminum, Aluminum alloys, Copper, Copper alloys, Fiber Reinforced Plastics and rigid plastics etc. The improved model of it is available to test very soft metals such as lead and tin and other soft materials such as soft plastics, rubber, felt and leather etc. High sensitivity. Featured with 100 scales, much more sensitive than Webster hardness testers applied in Aluminum alloys industry. No supporting required. Can test from only one side of the workpiece. No need to move or support the workpiece. Used to test super large and thick worpieces and assembly parts. Easy conversion. The test results can be converted to HB, HR, HV and HW easily through conversion table.

2. Principle and Structure

Barcol Impressor is a kind of indention hardness tester. It uses a special shape indenter impressed into the specimen by a standard string pressure and measures the indentation depth to obtain hardness value.

Barcol hardness value is:

$$HBa=\mathbf{100}-\frac{h}{0.0076}$$

HBa---Barcol hardness value

h------indentation depth (mm)

0.0076-----indentation depth for one unit of Barcol hardness

The structure of Barcol Impressor is illustrated in Fig.1.

The main testing system of Barcol Impressor is set in the frame. The indenter is in the full scale adjusting screw (indenter sleeve) with a plunger loaded by load spring on top. The test force applied on indenter by load spring through plunger is adjusted by load adjusting screw. The plunger moves up and down along with indenter, thus, the dial indicator shows hardness reading through the lever. The legs fixed at the back of the frame can insure the indenter be perpendicular to test surface. The enclosures at both left and right sides protect the inner system from being damaged and changed.

The top of indenter is 0.76mm, equivalent to 100 degrees upper on the top surface of full scale adjusting screw when the impressor is under nonworking condition. The indicator pointed on zero at this moment.

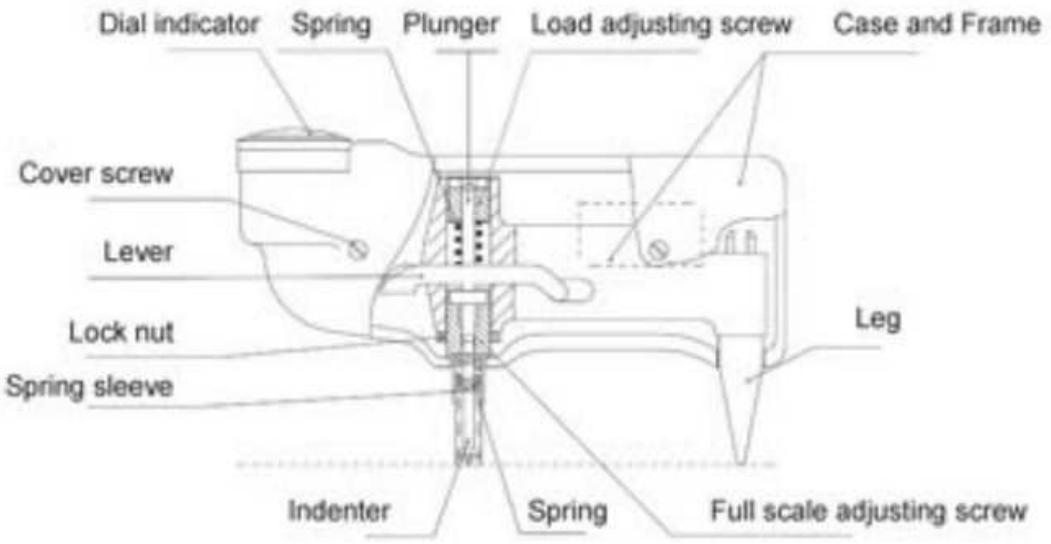

Fig.1 Structure of Barcol Impressor

3. Technical Parameters

Indenter: 26°panhead cone, head face diame ter 0.176mm
Testing Range: 0~100HBa，equivalent to 25~150HBW
Resolution: 0.5HBa
Indication error: hardness range 42~52HBa, ±2HBa
hardness range 84~88HBa ±1HBa
Repeatability error: hardness range 42~52HBa, ±2HBa
hardness range 84~88HBa ±1HBa
Net weight: 0.5kg

4. Operating Method

4.1 Verification of the Instrument

4.1.1 Zero Point Verification

Check the position of the indicator hand. It should point on the “0” on the indicator dial.The tolerance range is one graduation. If it exceeds, pls contact with the manufacturer.

4.1.2 Full Scale Verification

Put the impressor on a hard flat surface (e.g. glass sheet). Press on the enclosures to make the indenter back to full scale adjusting screw. Now the indicator should point at 100±1 (Note: do not impact or make the indenter slide when pressing, otherwise the indenter will be damaged). If the test reading exceeds the tolerance range (1 graduation), calibration of the full scale should be carried out according to Step 5.3.

4.1.3 Indication Verification

Put the standard hardness block on a hard flat surface and test it by the impressor. The dial indicator should point at the specified hardness values. If the test reading does not meet the requirements, calibration of the indication should be carried out according to Step 5.3.

4.2 Requirement of Specimen

4.2.1 The specimen surface should be smooth, clean, without mechanical damage. The surface can be light punishing to move off the scratch and coating.

4.2.2 The thickness of the specimen should be no less than 1.5mm.Obvious transformation trace shouldn’t occur after testing on the specimen surface. The dimension of the specimen should also ensure the minimum distance between the point of the indenter and each edge of is less than 3mm

4.2.3 To ensure the accurate testing, the indenter must be vertical to the specimen surface. Thus, the dimension of the specimen surface should be enough to make the leg of the impressor and the point of the indenter at the same level.

If the specimen is too small or narrow to make the leg of the impressor and the point of the indenter at the same level, block up the leg to realize it. Pay attention to that the two surfaces of the leg should be at the same level.

4.2.4 Make sure there is no previous testing indentation within 3mm around current testing point.

4.2.5 The specimen must be placed stably. Small specimen should be placed on the stable backing (such as steel sheet, glass etc.) The specimen can not lift, move or transform during testing procedure.

4.3 Testing Operation

Hold the Impressor and put it on the specimen stably. Apply the test force stably and promptly. Take the maximum reading on the dial estimated to 0.5 hardness unit. This reading result is the Barcol hardness value of the specimen. Do not impact or make the indenter slide when pressing, otherwise the indenter will be damaged.

When testing softer materials, the reading will be lower down gradually. Take the reading as far as possible to remain the maximum reading result.

5. Calibration of the Instrument

5.1 Calibration of zero point

The zero point of the instrument is stable and seldom goes wrong. If it has error, calibration of zero point should be carried out under manufacture’s guide.

5.2 Calibration of full scale

Screw off the pivot screw, and take out the main frame from the enclosure. Then screw off the lock nut and rotate the dull scale adjusting screw with the special wrench equipped with the instrument. The readings on the dial indicator will be lower down when the nut is screwed off, on the contrary, rise up when screwed. After adjustment, screw the lock nut and re-test on the glass sheet. The indicator should point at 100±1. If there is still any error, repeat the operation above until indicator points at 100±1.

5.3 Calibration of the indication

Screw off the load adjusting spring. The readings on the dial indicator will be lower down when the spring is screwed off, on the contrary, rise up when screwed. Repeat the operation above until the indicator points at the hardness value of the standard hardness block.

Test on another standard hardness block. The indicator should point at the hardness value of the standard hardness block. If there is still any error, do light adjustment. Test the instrument on both “hard” and “soft” standard hardness blocks after adjustment. The readings should all point at the hardness value of the standard hardness block. If not, the indenter may be damaged, change for a new one.

6. Indenter

6.1 Protection of the Indenter

The indenter of the instrument is a accurate part made of hard steel. The point of the indenter is machined accurately to very small size. Take; care during operation to avoid any damage. When the indenter reaches to the specimen, the instrument should be pressed carefully and stably to avoid slide or scratch. The indenter will be damaged if it slides on hard material especially on rough hard material. The indenter is not in the guarantee range, so it must be treated with care. Please replace it for a new one if it is damaged. Each instrument is attached with 2 spare indenters. Purchase more from the manufacturer.

Caution!!!

Do not polish and reuse the damaged indenter!

6.2 Wear of the indenter

The indenter will be lightly worn after frequent use. In that case, the reading result will lead to tolerance. So the indenter should be checked frequently.

Put the instrument on the glass sheet. The indicator should point at full scale 100±1. If not, it indicates the indenter is damaged. It also indicates the indenter is damaged if the readings don’t point at the hardness value of the standard hardness block when testing the instrument on the same surface.

The calibration of the instrument should be carried out if the indenter is damaged. Test the instrument on both “hard” and “soft” standard hardness blocks after adjustment. The readings should all point at the hardness value of the standard hardness block. If not, the indenter may be seriously damaged; its length can’t meet the required range; change for a new one. Re-calibration should be carried out after replacing the indenter.

6.3 Replace the indenter

The operation process of replacing indenter is as following:

6.3.1 Screw off the screw on the enclosure.

6.3.2 Hold on the spring sleeve to make sure it can't fall down. Take off the main frame of the instrument from the upward side of the enclosure.

6.3.3 Screw off the load adjusting screw until the cross recesses projects from the main frame.

6.3.4 Invert the instrument. Prevent the spring and plunger from falling down. Screw off the lock nut and take off the full scale adjusting screw.

6.3.5 Take off the previous indenter and put on a new one. Screw the full scale adjusting screw. Make the indenter reveal 5mm from the bottom of the frame.

6.3.6 Test on the glass sheet and take the maximum reading. Do not over load to avoid the indenter over deflecting. if the indicator exceeds 110, the dial indicator will be damaged. Adjust the full scale adjusting screw until the indicator points at 100±1.

6.3.7 Screw the lock nut. Re-inspect full scale value.

6.3.8 Inspect and calibrate the indication.

6.3.9 Re-fit on the instrument and inspect the full scale and indication.

7. Hardness Block

The instrument is attached with two hardness blocks," high value" and " low value" which are made of aluminum and aluminum alloys.

Only the front side signed with value of the hardness block is permitted to be used. To test on both the two sides will lead to wrong readings.

Avoid to test on the point within 3mm distance from the edge and previous indentation when testing the hardness block.

The reading obtained near the previous indentation will be not accurate.

Each instrument is attached with enough hardness blocks. Spare hardness blocks can be bought from the manufacturer.

8. Test Times

The error of Barcol Impressor is bigger than Brinell hardness tester and Rockwell hardness tester. In order to reduce the test error, test for several times and take the average reading. The softer specimen is, the more test times need to be carried out. The test times should be even more when testing composite material.

The recommended test times according to different hardness value on homogeneous material and heterogeneous material are shown as table 1 and table 2.

Table 1 Recommend test times for aluminum alloys materials (according to ASTM B648-2000)

Barcol Hardness	Min. Test Times
50	**6**
60	**5**
70	**4**
80	**3**

Table 2 Recommend test times for fiber reinforced plastics and rigid plastics (according to GB/T3854-2005)

rigid plastics		fiber reinforced plastics	
Barcol Hardness	**Min. Test Times**	**Barcol Hardness**	**Min. Test Times**
20	**9**	**30**	**29**
30	**8**	**40**	**22**
40	**7**	**50**	**16**
50	**6**	**60**	**10**
60	**5**	**70**	**5**
70	**4**		
80	**3**		

9. Model Selection

There are 3 models in Barcol series.

Model HT-10 which is equipped with standard load sp ring and standard indenter is in widest application. It is used to test aluminum and aluminum alloys, copper and copper alloys, fiber reinforced plastics, other reinforced plastics and unreinforced plastics etc. Its testing range is equivalent to 25-135HBW (500kg, 10mm).The typical Barcol hardness of aluminum and aluminum alloys of different grades and conditions are shown as table 3:

Table 3 Typical Bracol hardness of aluminum alloys

Alloys and heat treatment	**1100-0**	**3003-0**	**3003H14**	**2024-0**	**5052-0**	**5052H14**	**6061T6**	**2024T3**
Barcol Hardness	**35**	**42**	**56**	**60**	**62**	**75**	**80**	**85**

Model 935 which is equipped with softer load spring and standard indenter is used to test softer plastics, soft metals such as ead and tin and wood materials like floor etc. Its testing range is equivalent to 50-110HRR.

Model 936 which is equipped with softer load spring and indenter with bigger cone angle is used to test even softer materials such as leather, felt and soft wood etc.

10. Collocation

Standard Package

Tester

Leg

Standard hardness block (2 pcs)

Spare indenters (2 pcs)

Calibration wrench

Carrying case

Optional Accessories

High value Standard hardness block

Low value Standard hardness block

Spare indenters

10. Conversion

Barcol hardness can be converted to HB, HR, HV and HW, shown as table 4, Fig 2 and Fig 3.

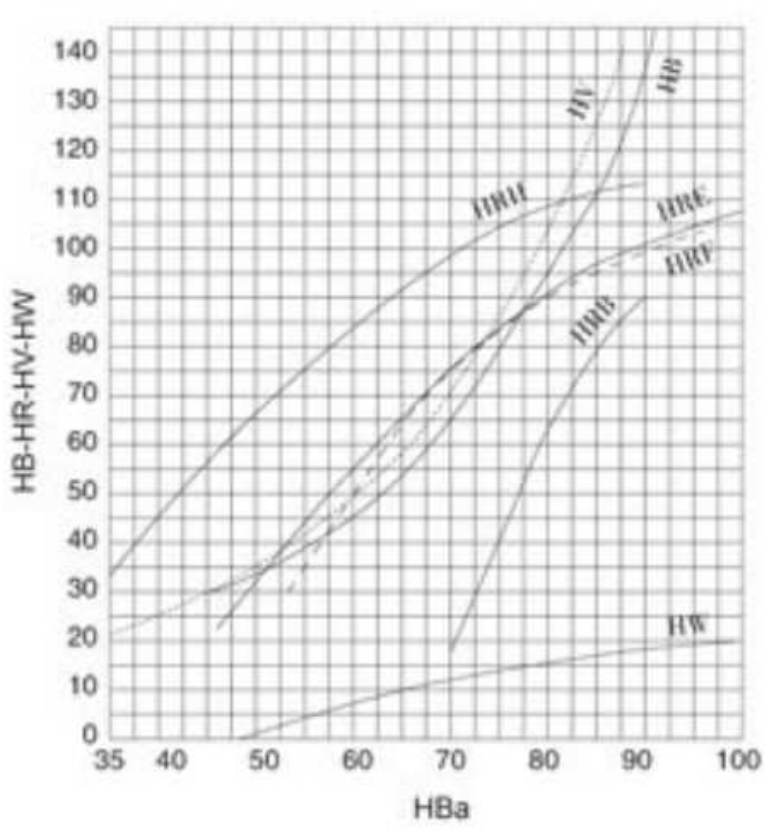

Fig 2.Relationship between Barcol hardness with HB, HR, HV and HW

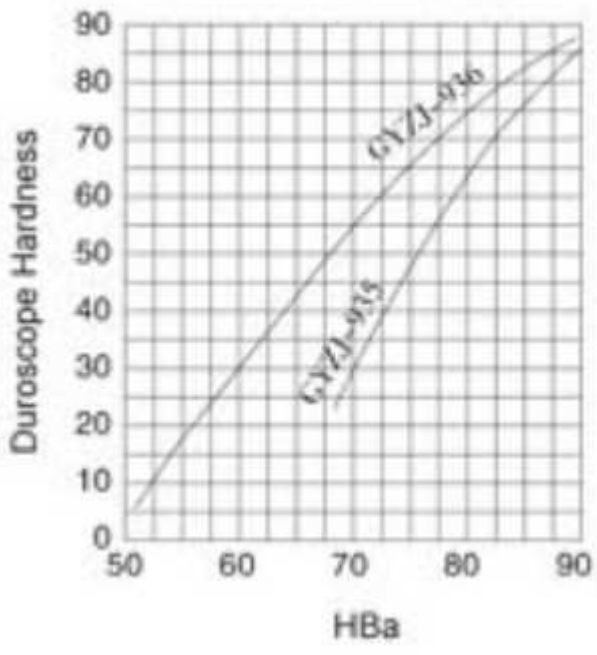

Fig 3. Relationship between Barcol hardness and Duroscope hardness

Table 4. Hardness Conversion Sheet

HBa 934-1	HB 10mm 500kg	HV 5kg	HW W-20	HR				HBa 934-1	HB 10mm 500kg	HV 5kg	HW W-20	HR			
				B	E	F	H					B	E	F	H
35		21					32	68	60	65	11.0		71	70	94
36		22					35	69	62	67	11.4		73	72	95
37		23					37	70	64	70	11.8	17	75	74	97
38		24					40	71	67	72	12.2	23	76	75	98
39		25					42	72	69	75	12.6	28	78	77	99
40	25	26					45	73	72	78	12.9	33	80	79	100
41	25	27					47	74	75	81	13.3	38	81	80	101
42	26	28					49	75	78	85	13.7	42	83	82	102
43	27	29					51	76	80	88	14.0	47	84	83	103
44	27	30					54	77	84	92	14.3	51	86	85	104
45	28	30					56	78	87	95	14.7	55	87	86	105
46	29	31					58	79	90	99	15.0	59	89	88	106
47	30	32			23		60	80	94	103	15.3	63	90	89	106
48	30	33	0.7		26		62	81	97	108	15.6	66	91	90	107
49	31	34	1.3		28		64	82	101	112	15.9	70	92	91	108
50	32	35	1.9		31		66	83	105	117	16.2	73	94	92	109
51	33	36	2.5		34		68	84	109	121	16.4	76	95	93	109
52	34	38	3.1		36		70	85	113	126	16.7	79	96	94	110
53	35	39	3.6		3	3	7	86	117	13	16.	8	97	95	11

					9	0	2			1	9	1			1
54	37	40	4.2		41	34	73	87	121	137	17.2	84	98	96	111
55	38	41	4.7		44	37	75	88	126	142	17.4	86	99	97	112
56	39	43	5.3		46	40	77	89	130		17.6	88	100	98	112
57	40	44	5.8		48	43	78	90	135		17.8	90	101	98	113
58	42	45	6.3		50	46	80	91	140		18.0		102	99	114
59	43	47	6.8		53	48	82	92	145		18.2		103	100	
60	45	49	7.3		55	51	83	93			18.4		103	100	
61	46	50	7.8		57	54	85	94			18.6		104	101	
62	48	52	8.3		59	56	86	95			18.7		105	102	
63	50	54	8.8		61	59	88	96			18.9		106	102	
64	51	56	9.2		63	61	89	97			19.0		106	103	
65	53	58	9.7		65	63	90	98			19.2		107		
66	55	60	10.1		67	66	92	98			19.3		107		
67	57	62	10.6		69	68	93	100			19.4		108		

Note: Because of the nature of soft metals, different testing systems can not establish uniform relationship between each other. So the conversion table and curves are only for reference. Suggest setting up Barcol hardness conversion relationship through testing on each kind of material.