



Designation: B 648 – 78 (Reapproved 2000)

## Standard Test Method for Indentation Hardness of Aluminum Alloys by Means of a Barcol Impressor<sup>1</sup>

This standard is issued under the fixed designation B 648; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers the determination of indentation hardness of aluminum alloys using a Barcol Impressor, Model No. 934-1.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

NOTE 1—Another model, No. 935, is for use on plastics but is not included in this test method and should not be used for aluminum alloys.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- E 6 Terminology Relating to Methods of Mechanical Testing<sup>2</sup>
- E 10 Test Method for Brinell Hardness of Metallic Materials<sup>2</sup>
- E 18 Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials<sup>2</sup>

### 3. Terminology

3.1 *Definitions*—The definitions of terms relating to hardness testing appearing in Terminology E 6 shall be considered as applying to the terms used in this test method.

### 4. Significance and Use

4.1 The Barcol Impressor is portable and therefore useful for in situ determination of the hardness of fabricated parts and individual test specimens for production control purposes.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee B07 on Light Metals and Alloys and is the direct responsibility of Subcommittee B07.05 on Testing.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 03.01.

4.2 This test method should be used only as cited in applicable material specifications.

### 5. Apparatus

5.1 *Barcol Impressor, Model 934-1*— See Fig. 1 and Fig. 2.

5.2 *Indenter*—The indenter shall consist of a hardened steel truncated cone having an angle of 26° with a flat tip 0.157 mm (0.0062 in.) in diameter. It shall fit into a hollow spindle and be held down by a spring-loaded plunger. See Fig. 2.

5.3 *Indicating Device*—The indicating dial shall have 100 divisions, each representing a depth of 0.0076 mm (0.00030 in.) penetration. The higher the reading, the harder the material.

### 6. Test Parts or Specimen

6.1 The testing area shall be smooth, clean, and free of mechanical damage. The surface may be lightly polished to eliminate scratches or die lines. It shall be such that it can be essentially perpendicular to the indenter during the test.

NOTE 2—The effect of curvature of the test specimen on the Barcol Impressor readings is presented in Appendix X1, Fig. X1.1.

6.2 *Dimensions*—Test parts or specimens shall be at least 1.5 mm ( $1/16$  in.) thick and large enough to ensure a minimum distance of 3 mm ( $1/8$  in.) in any direction from the indenter point to the edge.

### 7. Calibration

7.1 With the plunger upper guide backed out until it just engages the spring, place the impressor on a glass surface and press down until the penetrator point is forced all the way back into the lower plunger guide. The indicator should then read  $100 \pm 1$ . If it does not, loosen the locknut and turn the lower plunger guide in or out to obtain a reading of 100.

7.2 Read the hardness of a “hard” aluminum alloy reference disk supplied by the manufacturer of the impressor and, if necessary, adjust so that the reading is within the range marked on the disk.

7.3 Repeat the process with a “soft” reference disk.

7.4 If the reference readings cannot be obtained, subsequent measurements are not valid.



FIG. 1 Barcol Impressor, Model 934-1

**8. Procedure**

8.1 Support the test parts or specimens on a hard, firm surface if they are likely to bend or deform under the pressure of the indenter (Note 3). The indenter must be perpendicular to the surface being tested.

NOTE 3—Curved surfaces may be more difficult to support. When the load is applied, bending and spring action in the part or specimen should be avoided.

8.2 Grasp the impressor firmly between leg and point sleeve and set both on the surface to be tested. For irregular parts or small specimens this may require the impressor leg to be shimmed so that the indenter will be perpendicular to the test surface.

8.3 Quickly apply by hand sufficient pressure (4 to 7 kg, or 10 to 15 lb) on the housing to ensure firm contact with the test specimen and record the highest dial reading to the nearest 0.5

division (Note 4). Take care to avoid sliding or scraping while the indenter is in contact with the surface being tested.

NOTE 4—For relatively soft materials, the dial may indicate some drift toward lower numbers with time after the initial pressure. For this reason it is recommended that readings be made quickly and that the highest observed value be used.

8.4 Impressions should not be made within 3 mm (1/8 in.) of the edge of the part or specimen or of other impressions.

**9. Report**

9.1 The report shall include the following:

- 9.1.1 Identification of material tested,
- 9.1.2 Model and serial number of impressor,
- 9.1.3 Number of readings taken,
- 9.1.4 Average of hardness values rounded to the nearest whole scale reading, and
- 9.1.5 Date of test.

**10. Precision and Bias; Number of Readings**

10.1 Application of portable impressors such as the Barcol will produce greater variation in hardness readings than standard fixed-frame procedures such as Test Methods E 10 and E 18. On homogeneous materials, three readings are needed to maintain a variance-of-average of 0.28 at an 80 Barcol reading; for the same variance-of-average at 50 Barcol, six readings are needed. Table 1 shows the recommended sample sizes to obtain comparable variance at other hardness levels.

NOTE 5—These findings were obtained with a round robin conducted in a workshop with all participants present. Eight plastic materials of different hardness were evaluated with six different Barcol (934-1) Impressors. The report is filed with ASTM Headquarters.<sup>3</sup>

**TABLE 1 Recommended Sample Sizes to Equalize the Variance of the Average**

<sup>3</sup> Round-robin data have been filed at ASTM Headquarters as RR: D20-1087.

Hardness, M-934-1 Scale	Reading Variance	Coefficient of Variation, %	Variance of Average	Minimum No. of Readings
50	1.66	1.1	0.28	6
60	1.39	0.9	0.28	5
70	1.12	0.8	0.28	4
80	0.85	0.7	0.28	3