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Standard Test Method for Hardness of Electrical Contact Materials[1]

This standard is issued under the fixed designation B277; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the determination of the hardness of metallic materials used for electrical contacts. Rockwell, Rockwell superficial, Brinell, and microhardness tests are included, along with information on the limitations and use of these tests.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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 become familiar will all hazards including those identified in the appropriate Material Safety Data Sheet (MSDS) for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

E10 Test Method for Brinell Hardness of Metallic Materials

E18 Test Methods for Rockwell Hardness of Metallic Materials

E384 Test Method for Knoop and Vickers Hardness of Materials

3. Significance and Use

3.1 The Rockwell hardness and Rockwell superficial tests are useful when the test specimens are sufficiently thick (in relation to the indentor load) to ensure that the results are not affected by the flow of metal on the surface of the anvil. On a solid piece the flow of metal on the under surface may be detected by a bulge or marking. On composite pieces where the contact materials are attached to backings of a different material, the thickness limitations imposed for a solid piece shall apply to the contact material portion of such composite pieces.

NOTE 1—As a matter of information, it may be stated that tests on fine silver showed that on annealed samples having a Rockwell 15T hardness of 27, the readings were not affected on thicknesses 1/16 in. (1.6 mm) or over. On thicknesses of 1/32 in. (0.8 mm) Rockwell 15T scale readings of 72 and higher were not affected.

3.2 The microhardness test is of questionable significance when the metallic phases in a material are so large that the indentation does not represent an accurate average hardness. Sintered contact materials usually contain segregates differing greatly in hardness from the matrix hardness and may destroy the validity of microhardness readings.

3.3 Other aspects of significance and use shall be as described in the particular ASTM test method used, as listed in Section 2.

4. Sampling

4.1 Prepare test samples in accordance with the method selected from those listed in Section 2 and, where applicable, supplemented with the requirements in 5.3.

5. Procedure

5.1 Determine the hardness in accordance with one of the following:

5.1.1 Test Methods E18 subject to the additional requirements and precautions in 3.1, 5.2, and 5.3.

5.1.2 Test Method E384 subject to the additional requirements and precautions in 3.2 and 5.4.

5.1.3 Test Method E10.

5.2 When employing the Rockwell superficial hardness test (Test Methods E18) the specimen hardness shall be within the range of the selected scale, as shown in Table 1.

5.3 When using the Rockwell or Rockwell superficial hardness tests on contacts which are in rivet form, the shanks of such rivets may have insufficient cross-sectional area to support the test pressure. In such cases the shank shall be removed to form a flat surface for placement against the anvil. The welding projection on contacts designed for assembly by

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

TABLE 1 Permissible Hardness Ranges

Scale	Permitted Range
15T	20–90
30T	20–90
45T	10–90
15N	70–100
30N	40–100
45N	20–100

projection welding shall also be removed. Some rivet contacts are too small for the use of Rockwell superficial hardness testing, in which case the microhardness tests may be used.

5.4 When employing the microhardness test (Test Method E384) the minimum indentor load shall be 100 gf, except for specimens that have a thickness or diameter less than 0.005 in. (0.13 mm) in which case a 25 or 50 gf load shall be used.

5.4.1 When microhardness tests (Test Method E384) are employed at 100 gf or less load, make a minimum of five indentations. Obtain the reported microhardness value by averaging these indentations.

6. Reports

6.1 In addition to the requirements of the applicable hardness method used, the report shall include the following:

6.1.1 When it is necessary to make measurements on thin sections of material where results will be affected, this fact shall be stated in reporting the results, stating the thickness of the material tested.

6.1.2 When tests are made on surfaces having a spherical or cylindrical curvature, the radius of curvature shall be given in the report.

7. Precision and Bias

7.1 The precision and bias of this test method are as stated in the particular ASTM Test Method used (see 2.1 and Note 1).

NOTE 2—Interlaboratory Knoop hardness tests at 100 gf on noble alloys in the range of approximately 170 to 230 HK indicate that measured diagonal lengths have a standard deviation of approximately 1.4 μm that corresponds to 5.3 to 7.5 Knoop numbers respectively.

8. Keywords

8.1 contacts; electrical contact materials; hardness; microhardness