Designation: B576 − 94 (Reapproved 2021)

Standard Guide for Arc Erosion Testing of Electrical Contact Materials[1]

This standard is issued under the fixed designation B576; 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 guide covers the major variables which affect the rate of arc erosion of electrical contact materials and serves as a guide in developing more detailed specifications for arc-erosion tests.

1.2 Arc erosion testing involves some vaporization of material. It is the responsibility of the user to become familiar with all hazards including those identified in the appropriate Material Safety Data Sheet for the material being tested.

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

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Significance and Use

2.1 The significance of the variables set forth in this guide was proved by various laboratories using several test systems at test currents ranging from 100 to 35 000 A. These variables will be significant for any case where voltage and current are sufficient to produce arcing.

3. Major Variables

3.1 *Shape, Area, and Thickness:*

3.1.1 The area, shape, and thickness of the contact affect the erosion rates. As an example of shape effects, the radius of the spherical crown affects the erosion in at least two ways: (*1*) it changes the effective diameter of the contact and, (*2*) it affects the manner in which the arc moves about on the surface of the contact. A contact with a hemispherical crown presents no sharp edges that would result in different amounts of erosion products for a given amount of arcing and aids in the control of the arc when operating in air and other gases.

3.1.2 The contacts may be given a type of normal shape and surface roughness by a number of arcing operations prior to recording the contact loss. There may be a difference in the effect of shape and diameter for different environments.

3.1.3 Contact mounting, attachment, and bond integrity can affect the arc erosion of materials and should be specified.

3.2 *Contact Velocity and Maximum Arc Length*—The velocity of separation and the maximum arc length affect the erosion rate and, therefore, should be specified in formulating a test.

3.3 *Contact Orientation:*

3.3.1 The orientation of the contacts with respect to the earth's gravitational field may affect the erosion rate and, therefore, should be specified. For example, the mating planes of the contacts might be vertical or horizontal.

3.3.2 If the contact's mating planes are horizontal and a direct test current is used, the specifications should state whether the anode or cathode is in the upper position.

3.4 *Environment:*

3.4.1 The type, pressure, temperature, and humidity of the gas atmosphere or the type, pressure, and temperature of the surrounding oil, affect the erosion rate and should be specified.

3.4.2 The erosion rate in air may be quite different than that under oil.

3.5 *Arcing Current:*

3.5.1 An increase in arc current will cause an increase in the arc-erosion rate per coulomb of arcing, and thus it must be specified.

3.5.2 It follows then that the wave form of the arc current is important and source voltage and load current should be specified.

3.6 *Arcing Time*—The time duration of individual arcs on an electrical contact affects the erosion rate and thus it should be specified.

3.7 *Closing Force, Speed, and Bounce*—The severity of the damage caused by the closing arcs depends on the closing speed, closing force, and the number of bounces. All these three can be measured. The arc erosion that occurs because of

[1] This guide is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.05 on Precious Metals and Electrical Contact Materials.

Current edition approved Nov. 1, 2021. Published December 2021. Originally approved in 1973. Last previous edition approved in 2016 as B576 – 94 (2016). DOI: 10.1520/B0576-94R21.

closing arcs caused by contact bounce can be duplicated by properly specifying other items in this list with particular emphasis on contact velocity and maximum arc length. Unwanted closing arcs can be effectively eliminated from a contact test device, for example, by causing the test current to flow through the contacts after the contacts have been closed.

3.8 *Contact Body Temperature*—The mating contacts of a contact pair might have different temperatures and both should be measured or specified just before the arcing operation.

3.9 *Total Number of Arcing Operations*—The total number of arcs or, in other words, the time duration of the tests, must be specified for several reasons. First, the shape of the contact may change as the test progresses; secondly, chemical actions may take place to change the erosion rate as, for example, by formation of silver oxide on silver or tungsten oxide on tungsten.

3.10 *Arc Motion*—Arc motion produced by any means, such as magnetic fields, is important and should be specified.

3.11 *Polarity:*

3.11.1 Polarity may affect erosion rates and should be specified, that is, is it constant or alternating.

3.11.2 Tests in which the polarity is constant may give different erosion rates than those in which the polarity changes. Polarity effect could cause different surface conditions for successive arcs.

3.12 *Operation Rate*—The operation rate affects the operating temperature of the contact and, therefore, the erosion rate.

3.13 *Opening Speed and Opening Force*—These two factors affect the severity of the damage caused by the opening arc.

4. Keywords

4.1 arcing contacts; arc erosion; contacts; electrical contacts; electrical erosion