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## Standard Terminology Relating to Electrical Contacts and Their Use<sup>1</sup>

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### 1. Scope

1.1 The terms included in this list are those that are peculiar to electric contacts or general terms that have a specific meaning when related to electric contacts. The definitions were prepared assuming that the reader has a general knowledge in a physical science but is unfamiliar with the terminology of the literature of electric contacts.

### 2. Significance and Use

2.1 The terms in this standard are used in standards and literature related to electric contacts, materials for electric contacts and test methods for evaluating electric contacts. These terms may be difficult to locate in a general purpose dictionary or the definition in such a dictionary may not cover the meaning applied in the field of electric contacts.

### 3. Terminology

**a-spot**—the areas of two mating contacts through which current flows from one contact to the other.

**activation**—a process in which contamination of the surface of contacts causes arcing at lower than usual voltage or arcing persists at lower than usual current, or both. For example, palladium contacts operated in an organic vapor produce arcs at voltage and current less than the minimum arcing voltage and current because of the presence of carbon on the contact surfaces.

**anode fall**—the potential difference between the anode and the electrical discharge plasma.

*anodic (anode) material transfer*—see **material transfer**.

**arc discharge**—a self-sustaining, high current density, high temperature discharge, uniquely characterized by a cathode fall nearly equal to the ionization potential of the gas or vapor in which it exists.

**arc, anode**—the arc that occurs at less than a critical electrode spacing (see **arc, cathode**), and results in anode material loss.

**arc, cathode**—the arc that occurs at greater than a critical electrode spacing (see **arc, anode**), and results in cathode material loss.

**arc, shortest**—a limiting state of an arc in which the total arc voltage approaches the sum of the cathode and anode falls.

**blowout**—the displacement and lengthening of an arc to facilitate its extinction. The blowout effect can be achieved by a magnetic field, air blast, etc.

**brush**—a sliding contact member consisting of one or more sliders (see **sliders**).

**cathode fall**—the potential difference between the cathode and the electric discharge plasma.

*cathodic (cathode) material transfer*—see **material transfer**.

**constriction resistance**—the increase in resistance arising from a change in current density distribution. In electric contacts it is that portion of contact resistance resulting from the convergence of current into the a-spots.

**contact, n**—(a) a generic term that applies to a device or part of a device and that has the capability of completing or interrupting the flow of an electrical signal in a circuit, (b) may also be used with modifiers such as: electrical contact, arcing contact, noble metal contact, separable contact, etc.

<sup>1</sup> This terminology is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.91 on Editorial and Terminology.

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**contact**, *adj*—contact area, the part of an electrical device that is actually touching and where the electrical signal is expected to pass. Contact member, one of the electrical path parts that can make or break an electrical path.

**contact, arcing**—an electrical contact whose primary mode of wearout occurs on the contacting surfaces as a result of an arc formed between separating or closing contact pairs.

**contact bounce**—the unwanted operation of contacts immediately following intentional operation.

**contact(s), butting**—a type of contacts in which the direction of the motion of the moving contact is perpendicular to the contact faces. The contacts close and open with no appreciable sliding or rolling action.

**contact chatter**—the unwanted operation of contacts resulting from external forces operating on them. For example, vibration may cause contacts to open and close or “chatter.”

**contact-closing force**—the transient force between contacts during closure. At the first instant of closure this force is zero. It then builds up to a maximum value dependent on the forces and inertia of the contact system and finally stabilizes at the static contact force.

**contact, composite**—a contact made of two or more distinct materials or alloys bonded to each other. For example, a contact with a facing of a precious metal bonded to a base-metal backing.

**contact force**—the force to close, maintain, or open contacts. See also **insertion force**, **withdrawal force**, and **normal force**.

**contact noise**—a varying voltage across a pair of electric contacts due to conditions at their interface.

**contact, non-arcing**—mating electrical contact surfaces that do not experience wearout due to arc erosion that is opposite of arcing contacts.

**contact, pitted**—a contact that has numerous discrete hollows in its surface.

**contact pressure**—the force per unit area of physical contact between two contacts. This term is frequently but improperly used when contact force is meant. The area of physical contact is usually difficult to determine and quite different from the apparent area of contact.

**contact resistance**—the resistance to current flow offered by the contact interface, comprising the sum of the constriction resistance plus the film resistance.

NOTE 1—In a practical measurement, correction must be made for bulk resistance consisting of contact material, lead wires, etc.

**contact, screw**—a contact fabricated with an external thread for attachment to a support member or for adjustment.

**contact, sliding**—an electric contact which is expected to do its primary function during sliding.

**contact, solid**—a monolithic contact member.

**contact, spring**—a contact system in which one piece of material is used for both the driving spring and electric contact.

**contact, static**—an electric junction designed for infrequent separation and connection.

**contacts, wiping**—contacts that have some sliding motion during opening or closing.

**contact wipe**—relative tangential motion between contacting surfaces that occurs during the normal course of contact closure.

**corona (discharge)**—a self-sustaining discharge characterized by highly asymmetrical electric fields with the result that ionization predominantly occurs near the electrode with the higher potential gradient.

**crimp**, *v*—to establish an electrical and mechanical attachment between the two members by mechanically deforming one contact member around another. In most cases, one member is a stranded or solid wire, or a group of wires, the other is a hollow cylinder or partial cylinder that is deformed around the wire(s).

**dark (or Townsend) discharge**—a discharge which may or may not be self-sustaining. It is characterized by a uniform field, current in the microampere range, and a nonluminous inter-electrode space.

**electromigration**—(1)(1) Current-induced atomic diffusion in a solid metal due to electron momentum and the potential gradient, (2)(2) electrochemical process of growth of metallic path across an insulating surface under imposed electric field.

DISCUSSION—

The solid state process may cause significant material transport in regions of high current density such as a-spots in contacts. In devices with electrical contacts, the electrochemical process may form shorts between conductors under certain environmental conditions.

**film resistance**—that portion of the contact resistance that is due to the presence of contaminants on one or both of the contact members.

*fine transfer*—see **material transfer, bridge**.

**fretting**, *n*—small amplitude oscillatory motion, usually tangential, between two solid surfaces in contact.

DISCUSSION—

Here the term **fretting** refers only to the nature of the motion without reference to the wear, corrosion, or other damage that may ensue. The term fretting is often used to denote **fretting corrosion** and other forms of fretting wear. Usage in this sense is discouraged because of the ambiguity that may arise.

**fretting corrosion**—a form of fretting wear in which corrosion plays a significant role.

DISCUSSION—

In electrical contact interfaces involving non-noble metals, fretting corrosion can cause rapid and substantial increases in contact resistance as a result of localized appearance of insulating oxides and other corrosion products at the interface.

**fretting wear**—wear arising as a result of fretting. See **fretting**.

**friction polymerization**—the process by which organic compounds (such as adsorbed air pollutants) on mating surfaces that move relative to each other polymerize to yield compounds of high molecular weight.

NOTE 2—When this occurs on electrical contacts and the materials formed remain on the surface, contact resistance may increase substantially. The solid materials that are produced by the polymerization process are called “friction polymers” or “frictional polymers.”

**fritting (A-fritting)**—an electric breakdown between mating metallic contacts, separated by an insulating film, which occurs when the field strength exceeds approximately 1 000 000 V/cm. Metallic bridges are produced through the film if the fritting voltage is above the contact melting voltage.

**fritting voltage**—the voltage at which fritting occurs.

**glow discharge**—a self-sustaining discharge characterized by essentially symmetrical electrodes, low current density, and a high cathode fall of about 200 V.

**glowing connection (or contact)**, *n*—one that sustains emission of both visible light and heat while conducting electrical current.

**high resistance**—contact resistance exceeding an arbitrary, specified limit.

**inrush current**—a transient current that exists at the instant of contact closure and persists for a relatively short time.

**insertion force**—the force required to mate two connector halves.

**material transfer**—a general term to describe the carry-over of material from one electrical contact to another.

NOTE 3—When the discussion becomes specific, the term “gain” or “loss” is used with respect to a particular contact (for d-c application, anode or cathode; for a-c application, stationary contact or movable contact). For example, anode gain, anode loss, stationary contact gain.

*material transfer, negative*—see **material transfer**.

*material transfer, positive*—see **material transfer**.

**material transfer, bridge**—material transfer that occurs without the presence of a gaseous electric discharge. The filament of molten contact material that connects the two separating contacts does not rupture in the middle; thus there is a gain of material on one contact and a loss of material from the other.

**material transfer, cathode**—movement of contact metal from the cathode by means of a cathode arc.

**material transfer, needle**—material transfer that results in a buildup with a smaller diameter and a relatively great length.

*noise*—See **contact noise**.

**normal force**—that component of the force between contacting bodies perpendicular to their interface.

**opening force**—the force available to open the contacts.

**plasma**—a partially or totally ionized gas or vapor.

**porosity**—in metallic coatings, the presence of any discontinuity, crack, or hole in the coating that exposes a different underlying metal.

**positive column**—that region of an electric discharge between the cathode and anode falls.

**screw contact**—see **contact**, **screw**.

**self-sustaining discharge**—a discharge in which all carriers necessary for the transport of current in the discharge are produced by this discharge itself.

**showering**—a particular form of corona discharge characterized by strongly ionized streamers or streams of luminous plasma. It generally occurs at a field value just below that which is required for a complete breakdown.

**slider**—that member of a sliding contact pair, normally the smaller, which may be moved through a range of locations on the opposing member.

**sliding electrical contacts**—contacting members that perform their function while undergoing relative tangential motion.

**slip ring**—a continuous metal ring by means of which electrical current can be conducted to or from brush contacts. One electrical contact member is designed to rotate with respect to the other.

**slip ring assembly**—two or more slip rings with connecting leads or terminals that have been mounted to a common structure.

**slip ring capsule**—an assembly that includes a slip ring assembly, brushes, and bearings for conducting current on multiple circuits from a stationary body to one that may rotate.

**spark, discharge**—a non-self-sustaining discharge characterized by high luminosity and a ratio of lateral dimension to length that is substantially smaller than unity.

**sulfide creep**—in electrical contacts, spontaneous migration of a sulfide based corrosion product that occurs at elevated humidity across a gold rich surface.

DISCUSSION—

This process often involves copper sulfide produced by corrosion on a copper alloy spring that, under severe conditions, can completely cover a gold contact mounted on the spring.

**tarnish**—the chemical compound on the surface of a contact resulting from the reaction of the contact material and the inorganic constituents of the surrounding atmosphere.

**tweak**—to make a mechanical adjustment of a spring arm of an electrical contact assembly to adjust the force or position of the contact.

*wiper*—see **slider**. The term “wiper” is sometimes used interchangeably with the more preferred term “slider.”

**withdrawal force**—the force required to separate two mated connector halves.

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