



Standard Test Methods for Measuring Resistance of Electrical Connections (Static Contacts)¹

This standard is issued under the fixed designation B539; 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 These test methods cover equipment and techniques for measuring the resistance of static electrical connections such as wire terminations or splices, friction connectors, soldered joints, and wrapped-wire connections.

1.2 Measurements under two distinct levels of electrical loading are described. These levels are: (1) dry circuit, (2) and rated current. One or both of these levels of loading may be required in specific cases.

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 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:*²

B542 Terminology Relating to Electrical Contacts and Their Use

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

3. Terminology

3.1 *Definitions:*

3.1.1 See Terminology **B542** for definitions of contact resistance, film resistance, and constriction resistance.

3.1.2 *bulk resistance, n*—the resistance a contact assembly would have if it were solid metal of an identical geometry so

that the nominal contact area offered zero resistance. When measuring *contact resistance* one attempts to include as little *bulk resistance* as possible in the measurement, by placing measuring probes as close to the contact interface as practical.

3.1.3 *connection resistance, n*—the resistance from the termination point on one end of a device containing static contacts, through the contacts to the termination point on the other end of the device. The termination point is the location on a terminal of a device where a wire or printed circuit path electrically connects to the terminal. This resistance is the value of resistance displayed by the device in a circuit application.

3.1.3.1 *Discussion*—The term contact resistance is often used in commercial literature to indicate the connection resistance displayed by the device in a standard application. In the more rigorous usage of contact resistance, the connection resistance is the sum of the contact resistance plus the bulk resistance of leads within the device that go to the static contacts from the point that the leads are connected to the external circuitry. Measurement of contact resistance independent of all bulk resistance is very difficult for most commercial devices.

3.1.4 *dry circuit, n*—a circuit in which the *open-circuit* voltage is less than or equal to 20 mV. Current is usually low in a *dry circuit*, but a *low-current circuit* is not necessarily a *dry circuit*. When the applied voltage (*open-circuit voltage*) is too low to cause any physical changes in the contact junction, such as break-down of thin insulating films or softening of contact asperities, the circuit is said to be a *dry circuit*.

3.1.5 *open-circuit voltage, n*—the steady-state voltage which would appear across the contacts if they were opened.

3.1.6 *static contacts, n*—electric junctions designed for infrequent separation and connection, and intended to perform their function only when contacting members are stationary relative to each other. This definition includes crimped, welded, brazed, riveted, or soldered joints; friction connections such as pin and socket connectors or taper pins, twisted-wire splices; and connections made with screws, or bolts and nuts between electrical wiring and components. The definition excludes relay contacts, slip rings and commutators, and switches and circuit breakers.

¹ These test methods are under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and are the direct responsibility of Subcommittee B02.11 on Electrical Contact Test Methods.

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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.