INTERNATIONAL

Designation: B 854 – 98

# Standard Guide for Measuring Electrical Contact Intermittences[1]

This standard is issued under the fixed designation B 854; 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 The techniques described in this guide apply to electrical circuits that include one or more electrical contacts in devices such as slip rings, separable connectors, electromechanical relays or closed switch contacts. The user should determine applicability for other devices.

1.2 The range of techniques described apply to circuit discontinuities (intermittences) of durations ranging from approximately 10 nanoseconds to several seconds and of sufficient magnitude to cause alteration of the circuit function. Extension of the guide to shorter duration events may be possible with suitable instrumentation. Events of longer duration may be monitored by techniques for dc measurements such as those described in Test Methods B 539 or by adaptation of methods described in this guide.

1.3 The techniques described in this guide apply to electrical circuits carrying currents typical of signal circuits. Such currents are generally less than 100 ma. Extension of these techniques to circuits carrying larger currents may be possible, but the user should evaluate applicability first.

1.4 *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:*

B 539 Test Methods for Measuring Contact Resistance of Electrical Connections (Static Contacts)[2]

B 542 Terminology Relating to Electrical Contacts and Their Use [2]

B 615 Practice for Measuring Electrical Contact Noise in Sliding Electrical Contacts[2]

B 878 Test Method for Nanosecond Event Detection for Electrical Contacts and Connectors[2]

2.2 *Other Documents:*

IEC Publication 512, Test 2e Contact Disturbance[3]

EIA-364-46 Continuity Test Procedure for Electrical Connectors [4]

## 3. Terminology

3.1 Terms relevant to this guide are defined in Terminology B 542 except as noted in the following section.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *intermittence*—a transient increase in the voltage drop across a pair of electrical contacts.

## 4. Significance and Use

4.1 This guide suggests techniques to evaluate intermittences in a contact pair while it is subjected to simulated or actual environmental stress. Such measurements are a valuable tool in predicting circuit performance under these stress conditions and in diagnosing observed problems in circuit function under such conditions.

4.2 This document is intended to provide some general guidance on the best available practices for detecting, quantifying, characterizing and reporting short duration intermittences in circuits containing electrical contacts. Certain environmental stresses such as mechanical shock, vibration or temperature change may cause intermittences. These measurement procedures include methods applicable to contacts operating under various conditions in testing or in service.

4.3 Practice B 615 defines methods for measuring electrical contact noise in sliding electrical contacts. In contrast Guide B 854 provides guidance to the various methods for measuring similar phenomena in static contacts.

## 5. Apparatus

5.1 *General Comments*—The apparatus required varies depending upon the technique selected and the parameters (such as duration and magnitude) of the intermittence that the user wants to detect. In general, the cabling must be capable of

[1] This guide is under the jurisdiction of ASTM Committee B-2 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.11 on Electrical Contact Test Methods.

Current edition approved Oct. 10, 1998. Published January 1999.

[2] *Annual Book of ASTM Standards*, Vol 02.04.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[4] Available from Electronic Industries Association, 2001 Pennsylvania Ave NW, Washington D.C. 20006.

**TABLE 1 Comparison of Methods of Monitoring Electrical Contact Intermittences**

| Method | Typical Number of Channels | Typical Event Characterization | Possible Advantages |
|---|---|---|---|
| Oscilloscope | 1, 2 or 4 | ΔV vs time | detailed characterization of each event |
| Custom Circuitry | 1 per circuit | Presence or absence of one or more events during a preselected monitoring interval, such events defined as above a preselected threshold of ΔR and duration, the number of events during the interval may or may not be recorded. | Ability to closely model actual circuit conditions, allows use of various technologies in the transmitting and receiving devices |
| Event Detector | 1 to 64 | Presence or absence of one or more events during a preselected monitoring interval, such events defined as above a preselected threshold of ΔR and duration, but the number of events during the interval is not recorded. | Multichannel capability, selection of thresholds for events to be counted |
| Bit Error Rate | 1 | ratio of errors to number of bits transmitted | The format of the results is readily applicable to ranking of interconnection devices with respect to transmission quality for a specific signal format |

carrying signals of the speed to be detected in the study, and must be isolated from sources of noise that may cause false indications.

5.2 *Special Precautions for Measurements Involving Events Less than 1 Microsecond in Duration*—Detection of events of duration less than 1 microsecond will require special attention to the wiring of the detection circuits and instrumentation. Such attention may include using coaxial cable, shielding the apparatus from interferences and minimizing cable lengths.

5.3 *Specific Apparatus*—The apparatus required will vary depending upon the measurement method selected and the environmental stresses imposed during the test.

## 6. Procedure

6.1 *General Comments*—The following sections describe, in general terms, several methods that have been used to detect or measure contact intermittences. The user should select an appropriate method and adapt it as required. Table 1 presents a comparison of the attributes of the various methods. The following list covers questions that the user should answer before selecting a test method.

6.1.1 What is the definition of an intermittence in the intended application? For example, what resistance change over what time interval constitutes an intermittence, or what error occurs if the contact resistance changes, or what other definition is appropriate for the intended purpose of the test results?

6.1.2 Is it necessary to monitor more than one contact simultaneously? If so, is it acceptable to connect the contacts in series? If contacts cannot be connected in series, how many contacts must be measured simultaneously?

6.2 Test results should be reported in a format appropriate for the application and consistent with the format supplied by the test instrument.

6.3 *Oscilloscope*—In this method, an oscilloscope is wired to monitor the potential across the contact(s) of interest while a signal is passed through the contacts. Standards such as IEC Publication 512, Test 2e or EIA 364-46 are often implemented using this method. Practice B 615 provides a specific circuit that uses this method. Examples of the use of this method are shown in the reference by Currence and Rhoades. [5]

6.3.1 Fig. 1 shows a schematic representation of an example of how this method may be implemented. In selecting an oscilloscope, choose a model with response time fast enough to observe events of the duration of interest in the study. The user may find it convenient to use an oscilloscope capable of storing and printing results.

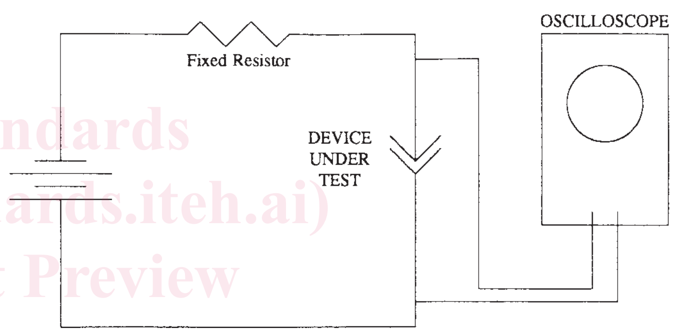


**FIG. 1 Schematic Representation of Oscilloscope Method**



6.4 *Custom Circuitry*—In this method, the user assembles circuitry to measure the effects of the intermittences under the conditions of interest. For example, the circuitry may simulate the type of source and detector circuitry that the user plans to design into a system. Alternatively, the user may design circuitry based on specialized components to achieve capabilities different from those found in commercial instruments. An example of custom circuitry was described by Abbott and Schreiber. [6]

6.4.1 Fig. 2 shows a schematic representation of an example of how this method may be implemented. The source and detector incorporate the specific devices, technology, driver

[5] Currence, R. and Rhoades, W., "Predicting, Modeling and Measuring Transient Resistance Changes of Degraded Electrical Contacts," Electrical Contacts, Proceedings of the 29th Meeting of the Holm Conference on Electrical Contacts, Illinois Institute of Technology, p. 81, 1983.

[6] Abbott, W. H. and Schreiber, K. L., "Dynamic Contact Resistance of Gold, Tin and Palladium Connector Interfaces During Low Amplitude Motion," Proceedings of Holm Conference, 1981, p. 211.