INTERNATIONAL

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Standard Guide for Mixed Flowing Gas (MFG) Tests for Electrical Contacts[1]

This standard is issued under the fixed designation B845; 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 pertain to mixed flowing gas (MFG) tests containing species that are applied to evaluate devices containing electrical contacts such as slip rings, separable connectors, electromechanical relays or switch contacts. These techniques may be relevant to other devices, but it is the responsibility of the user to determine suitability prior to testing.

1.2 The MFG tests described in this guide are designed to accelerate corrosive degradation processes. These accelerations are designed such that the degradation occurs in a much shorter time period than that expected for such processes in the intended application environment of the device being tested. Application environments can vary continuously from benign to aggressively corrosive. Connectors and contacts within closed electronic cabinets may be affected by an environment of different severity than the environment on the outside of such cabinets. In general, indoor environments are different than outdoor environments. The MFG tests described herein, being discrete embodiments of specific corrosive conditions, cannot be representative of all possible application environments. It is the responsibility of the test specifier to assure the pertinence of a given test condition to the specifier's application condition.

1.3 The MFG tests described herein are not designed to duplicate the actual intended application environment of the device under test. An extended bibliography that provides information which is useful to test specifiers to assist them in selecting appropriate test methods is included in this guide. The bibliography covers the scope from application condition characterization, single and multiple gas effects, and material and product effects to key application and test variables as well as discussions of atmospheric corrosion processes.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *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.*

1.6 *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. Referenced Documents

2.1 *ASTM Standards:*[2]

B542 Terminology Relating to Electrical Contacts and Their Use

B808 Test Method for Monitoring of Atmospheric Corrosion Chambers by Quartz Crystal Microbalances

B810 Test Method for Calibration of Atmospheric Corrosion Test Chambers by Change in Mass of Copper Coupons

B825 Test Method for Coulometric Reduction of Surface Films on Metallic Test Samples

B826 Test Method for Monitoring Atmospheric Corrosion Tests by Electrical Resistance Probes

B827 Practice for Conducting Mixed Flowing Gas (MFG) Environmental Tests

2.2 *Other Documents:*

EIA-364B-TP65 Mixed Industrial Gas Test Procedure[3]

IEC Standard 68-2–42 Basic Environmental Testing Procedures, Test K_c Sulphur Dioxide Test for Contacts and Connections[4]

IEC Standard 68-2–43 Basic Environmental Testing

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[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 and 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.

[3] Available from IHS, 15 Inverness Way East, Englewood, CO 80112, http://www.global.ihs.com.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

Procedures, Test K_d Hydrogen Sulfide Test for Contacts and Connections[4]
IEC Technical Trend Document 68-2–60 TTD Environmental Testing, Corrosion Tests in Artificial Atmosphere at Very Low Concentration of Polluting Gas(es)[4]
IEC 68-2–60 (second edition) Environmental Testing—Part 2: Tests—test Ke: Flowing mixed gas corrosion test, 1995
IEEE P1156.1 Environmental Specifications for Computer Modules (Draft 4 Approved June 17, 1993.)[5]

3. Terminology

3.1 Terms relevant to this guide are defined in Terminology B542 except as noted in the following section.

3.2 *Other term:*

3.2.1 *mixed flowing gas test, n*—a laboratory test conducted in air that flows through a test chamber in which the temperature, relative humidity, concentrations of gaseous pollutants, and other critical variables are carefully defined, monitored and controlled.

4. Significance and Use

4.1 Preservation of a conducting surface on electrical contact is vital to the continued functioning of such contacts. Contamination of the surface with insulating layers formed by corrosion processes is one potential hazard. Laboratory testing of contacts in MFG tests is used to assess the effectiveness of design features and materials.

4.2 MFG tests are used in development studies of processes and materials for contacts. For example, coupon specimens may be exposed to MFG tests to evaluate new contact materials, layers of new coating materials on a supporting substrate, reduced coating thicknesses, or protective surface treatments.

4.3 MFG tests are also employed to test the durability of a finished product with respect to atmospheric corrosion. For example, finished connectors may be exposed to a MFG test and their performances compared against each other or against a set of fixed requirements. Relays or switch contacts may be exposed in the operated and non-operated conditions to compare performance.

4.4 MFG tests are useful for determining the effectiveness of connector housings and shrouds as barriers to ingress of atmospheric corrodants to the contact surfaces. These tests can also be used to assess the screening of the metal-to-metal contact areas of mated connectors.

4.5 MFG tests are employed as qualification tests to determine connector failure rates in application environments for which correlation between test and application has previously been established.

4.6 This guide provides test conditions which are to be applied in conjunction with Practice B827 which defines the required test operation and certification procedures, tolerances, and reporting requirements. Where the test specifier requires certifications or tolerances different than those provided in Practice B827, the required certifications or tolerances shall be part of the test specification. Differences from the specifications in Practice B827 shall be reported in the test report provided by the test operator to the test specifier. Specification of one of the test conditions defined in this document in the form of a statement such as, "Parts shall be tested in accordance with ASTM B845 Method Z.", implicitly requires test condition, Z, applied according to Practice B827.

5. Procedure

5.1 Decide upon a test plan appropriate for the contacts being evaluated. Consider test parameters such as preconditioning, performance measurement and other evaluation techniques, and experimental controls.

5.2 Select a MFG test and exposure length appropriate for the parts being evaluated. Table 1 lists a number of such tests that have been documented in the technical literature. The next section provides brief discussions of the origins and intended purpose of each of the methods.

6. Abstracts of Methods

6.1 *Method A*—Method A was originally developed as a highly accelerated test to stress equipment that might be exposed to environments with high levels of air pollution from combustion of high sulfur coal (**1**).[6] The method is included in this list for completeness. It is generally not considered realistic for evaluation of electronic equipment for the vast majority of applications. Typical exposure time is 4, 10 or 21 days, depending upon the specification for the product under test.

6.2 *Method B*—Method B was originally developed as a European standard, and has largely been replaced by methods with lower levels of sulfur bearing gases (**2**). The method is included in this list for completeness. It is generally not considered realistic for evaluation of electronic equipment for the vast majority of applications. Typical exposure time is 4, 10 or 21 days, depending upon the specification for the product under test.

6.3 *Method C*—Method C was developed in Europe as an alternative to Method A in response to requests for a less aggressive test that would simulate exposures in less aggressive environments (**3**,**4**). Method C may simulate the majority of usage environments better than Method A. Typical exposure time is 4, 10 or 21 days depending upon the specification for the product under test.

6.4 *Method D*—Method D was developed in Europe as an alternative to Method B for the same reasons cited in the above discussion of Method C (**3**,**4**). Typical exposure time is 4, 10 or 21 days, depending upon the specification for the product under test.

6.5 *Method E*—Method E was developed in Europe as a first step toward a test containing more than one pollutant gas (**3**,**4**).

[5] Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., P.O. Box 1331, Piscataway, NJ 08854-1331, http://www.ieee.org.

[6] The boldface numbers in parentheses refer to a list of references at the end of this guide.