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EIA STANDARD

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WITHSTANDING VOLTAGE TEST PROCEDURE FOR ELECTRICAL CONNECTORS, SOCKETS AND COAXIAL CONTACTS

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(Revision of EIA-364-20B)

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Electronic Components, Assemblies & Materials Association

ELECTRONIC COMPONENTS, ASSEMBLIES & MATERIALS ASSOCIATION

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TEST PROCEDURE No. 20C

WITHSTANDING VOLTAGE TEST PROCEDURE FOR ELECTRICAL CONNECTORS, SOCKETS AND COAXIAL CONTACTS

(From EIA Standards Proposal No. 5051 formulated under the cognizance EIA CE-2.0 Committee on National Connector Standards, and previously published in EIA-364-20B.)

1 Introduction

1.1 Scope

This standard applies to electrical connectors, sockets and coaxial contacts.

1.2 Object

The object of this test is to describe a method for measuring the withstanding voltage.

2 Test Resources

2.1 Equipment

2.1.1 High voltage source

The nature of the potential (ac or dc) shall be as specified. When an alternating potential is specified, the test voltage provided by the high-voltage source shall be nominally 60 Hz in frequency and shall approximate, as closely as possible, a true sine wave in form. Other commercial power frequencies may be used for inplant quality conformance testing, when specified. All alternating potentials shall be expressed as root-mean-square values, unless otherwise specified. The kVa rating and impedance of the source shall be such as to permit operation at all testing loads without serious distortion of the waveform and without serious change in voltage for any setting. When the test specimen demands substantial test source power capacity, the regulation of the source shall be specified. When a minimum kVa rating is required, it shall be specified. When a direct potential is specified, the ripple content shall not exceed 5% rms of the test potential. When required, a suitable current-limiting device shall be used to limit current surges to the value specified.

2.1.2 Voltage measuring device

A voltmeter shall be used to measure the applied voltage to an accuracy of ± 5%, unless otherwise specified. When a transformer is used as a high-voltage source of alternating potential, a voltmeter connected across the primary side or across a secondary or tertiary winding may be used provided it is previously determined that the actual voltage across the test specimen will be within the allowable tolerance under any normal load condition.

2.1.3 Reduced pressure chamber

A chamber with a viewing window capable of providing the barometric pressures specified; see 2.1.2, shall be used. Means shall be provided to apply the test voltage to the connector while the connector is at reduced pressure in the chamber. A pressure reading device with an accuracy of ± 5%, unless otherwise specified, shall be used to monitor the pressure in the chamber throughout the test.

2.1.4 Fault indicator

Suitable means shall be provided to indicate the occurrence of disruptive discharge and leakage current in case it is not visually evident in the specimen. The voltage measuring device of 2.1.2, the leakage current measuring device of 2.1.5, an appropriate indicator light, or an overload protective device may be used for this purpose.

2.1.5 Leakage indicator

When any leakage current requirement is specified, a suitable method shall be used to measure the leakage current to an accuracy of at least 5 % of the specified requirement. Unless otherwise specified, the leakage current shall not exceed 5 mA.

3 Test specimen

3.1 Description

A test specimen shall consist of a plug, a receptacle, a mated plug and receptacle, or a coaxial pin and socket contact as specified in the referencing document.

3.2 Preparation

When special preparations or conditions such as special test fixtures, reconnections, grounding, isolation, or immersion in water, are required, they shall be specified in referencing document.

4 Test procedure

4.1 Points of application

4.1.1 Method A

The test voltage shall be applied between the most closely spaced contacts and between connector shell and the contacts closest to the shell.

4.1.2 Method B

The test voltage shall be applied between adjacent contacts as specified in the referencing document.

4.1.3 Method C

The test voltage shall be applied between each contact in turn, and all other contacts and shell connected together.

4.1.4 Method D

The test voltage for coaxial contacts shall be applied between the inner and outer conductors.

4.2 Barometric pressure (at sea level)

Since the barometric pressure greatly affects the withstanding voltage characteristics of the connector or coaxial contacts between the terminals through air, this pressure shall be specified as a requirement of the test. Test voltages shall be specified that allow for the decrease in withstanding voltage capability that occurs at reduced barometric pressures. A basic withstanding voltage requirement should be specified in every case for sea level applications. If required, depending on the connector or coaxial contacts application, a basic withstanding voltage requirement shall be given for a reduced pressure that approximates the reduced pressure under that the connector or coaxial contacts are expected to operate.

4.2.1 Reduced barometric pressure

The connectors or coaxial contacts shall be mounted in the test chamber as specified and the pressure reduced to the value indicated in one of the test conditions in table 1, as specified. While the connectors or coaxial contacts are maintained at the specified pressure, and after sufficient time has been allowed for all entrapped air in the chamber to escape, the connectors or the coaxial contacts shall be subjected to the specified tests.

Table 1 - Test conditions

Test conditions	Barometric pressure		Altitude [1)]	
	Inches of mercury	mm of mercury	Feet	Meters
I	27 to 31	685 to 785	Sea level	Sea level
II	8.90 maximum	226 maximum	30,000	9,144
III	3.44 maximum	87 maximum	50,000	15,240
IV	1.31 maximum	33 maximum	70,000	21,336
V	0.315 maximum	8 maximum	100,000	30,480
VI	5.11×10^{-8} maximum	1.3×10^{-6} maximum	656,000	199,949
VII	17.3 maximum	439 maximum	15,000	4,572
VIII	0.043 maximum	1.09 maximum	150,000	45,720

NOTE

1) Altitude is given as a reference only and should not be specified without barometric pressure as a test requirement.

4.3 Test voltage

Specimens shall be subjected to a test voltage of the magnitude and nature (ac or dc) specified.

4.4 Rate of application

The test voltage shall be raised from zero to the specified value as uniformly as possible, at a rate of approximately 500 volts (rms or dc) per second, unless otherwise specified. At the option of the manufacturer, the test voltage may be applied instantaneously during inplant quality conformance testing.

4.5 Duration of application

Unless otherwise specified, the test voltage shall be maintained at the specified value for a period of 60 seconds. Unless otherwise specified, for inplant quality conformance testing the time may be reduced to 5 seconds minimum. Upon completion of the test, the test voltage shall be gradually reduced to avoid voltage surges. At the option of the manufacturer, the test voltage may be removed instantaneously during inplant conformance testing.

4.6 Examination and measurement of specimen

During the withstanding voltage test, the fault and leakage indicators shall be monitored for evidence of disruptive discharge and leakage. Following this, the specimens shall be examined and measurements shall be performed to determine the effect of the dielectric withstanding voltage test on specific operating characteristics, when specified. A failure is the occurrence of a disruptive discharge as evidenced by flashover (surface discharge), sparkover (air discharge), breakdown (puncture discharge) or leakage in excess of the maximum specified; see 2.1.5.

5 Details to be specified

The following details shall be specified in the referencing document:

5.1 Special high voltage source, if applicable; see 2.1.1

5.2 Minimum kilovoltampere rating, if applicable; see 2.1.1

5.3 Current surge limits, and limiting device, if applicable; see 2.1.1

5.4 Voltmeter accuracy, if other than at least 5 %; see 2.1.2

5.5 Leakage current if other than specified in 2.1.5

5.6 Define test specimen (mated or unmated); see 3.1

5.7 Special preparations or conditions, if required; see 3.2

5.8 Method of connection of test voltage to specimen, if significant; see 3.2

5.9 Points of application of test voltage; see 4.1

5.10 Barometric pressure; see 4.2

5.10.1 Dielectric withstanding voltage requirements at sea level; see 4.2

5.10.2 Dielectric withstanding voltage requirements at reduced pressure, if applicable; see 4.2

5.10.3 Test during and after subjection to reduced pressure; see 4.2.1

5.10.4 Method of mounting in test chamber; see 4.2.1

5.11 Magnitude of test voltage; see 4.3

5.12 Nature of potential (ac or dc); see 4.3

5.13 Test voltage and duration for implant quality conformance testing; see 4.5

5.14 Duration of application of test voltage for qualification testing if other than 60 seconds; see 4.5

5.15 Examination and measurement of specimen, detail requirements (if required) ; see 4.6

5.16 Number of specimens to be tested.

6 Test documentation

Documentation shall contain the details specified in clause 5, with any exceptions, and the following:

6.1 Title of test

6.2 Specimen description include fixturing

6.3 Test equipment used, and date of last and next calibration

6.4 Test procedure

6.5 Values and observations

6.6 Date of test and name of operator

Annex A

A Normative

A.1 The test consists of the application of a voltage higher than rated voltage for a specific time between mutually insulated portions of a connector or between insulated portions and ground. For purposes of standardization, the withstanding voltage shall be established as 75% of the minimum breakdown voltage of the connector, and it is suggested that the operating rated voltage of the connector be established as 1/3 of the withstanding voltage.

Annex B

B Informative

B.1 This test is often erroneously termed a voltage breakdown or dielectric strength test. It is not intended that this test cause insulation breakdown or that it be used for detecting corona. It serves to determine whether insulating materials and spacings in the component parts are adequate. When a connector is faulty in these respects, application of the test voltage will result in either disruptive discharge or deterioration. Disruptive discharge is evidenced by flashover (surface discharge), sparkover (air discharge), or breakdown (puncture discharge).

B.2 Dielectric behavior of gases and solids is affected in various degrees by many factors, such as atmosphere temperature, humidity, and pressure; condition and form of electrodes; frequency, waveform, rate of application, and duration of test voltage; geometry of the specimens; rate of application, and duration of test voltage; geometry of the specimens; mechanical stresses; and previous test history. Unless these factors are properly selected as required by the type of dielectric, or suitable correction factors can be applied, comparison of the results of individual dielectric withstanding voltage test may be extremely difficult.

B.3 The withstanding voltage shall never be used as the operating rated voltage of the connector. The withstanding voltage test should be used with caution particularly in implant quality conformance testing, as even an overpotential less than a breakdown voltage may injure the insulation and thereby reduce its safety factor. Therefore, repeated application of the test voltage on the same specimen is not recommended. In cases when subsequent application of the test potential is specified in the test routine, it is recommended that the succeeding tests be made at reduced potential. When either alternating-current (AC) or direct-current (dc) test voltage is free of recurring transients or high peaks. Direct potentials are less damaging than alternating potentials that are equivalent in ability to detect flaws in design and construction. However, the latter are usually specified because high alternating potentials are more readily obtainable. Since deterioration due to excessive leakage currents may have an adverse effect on the electrical parameters or physical characteristics of the connector, the leakage current during the withstanding voltage test shall be limited to a maximum of 5 mA. Suitable precautions shall be taken to protect test personnel and apparatus because of the high potentials used.

EIA Document Improvement Proposal

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