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DEPARTMENT OF DEFENSE

TEST METHOD STANDARD

METHOD 301, DIELECTRIC WITHSTANDING VOLTAGE

AMSC N/A

FSC 59GP

FOREWORD

1. This standard is approved for use by all Departments and Agencies of the Department of Defense.

2. This entire standard has been revised. This revision has resulted in many changes to the format, but the most significant one is the splitting the document into test methods. See MIL-STD-202 for the change summary.

3. Comments, suggestions, or questions on this document should be emailed to std202@dla.mil or addressed to: Commander, Defense Logistics Agency, DLA Land and Maritime, ATTN: VAT, P.O. Box 3990, Columbus, OH 43218–3990. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil.

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METHOD 301
DIELECTRIC WITHSTANDING VOLTAGE

1. SCOPE

1.1 Purpose. The dielectric withstanding voltage test (also called high-potential, over potential, voltage-breakdown, or dielectric-strength test) consists of the application of a voltage higher than rated voltage for a specific time between mutually insulated portions of a component part or between insulated portions and ground. This is used to prove that the component part can operate safely at its rated voltage and withstand momentary overpotentials due to switching, surges, and other similar phenomena. Although this test is often called 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, rather, it serves to determine whether insulating materials and spacing in the component part are adequate. When a component part 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). Deterioration due to excessive leakage currents may change electrical parameters or physical characteristics.

1.2 Precautions. The dielectric withstanding voltage test should be used with caution particularly in inplant quality conformance testing, as even an overpotential less than the 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 voltages are used, care should be taken to be certain that the test voltage is free of recurring transients or high peaks. Direct potentials are considered less damaging than alternating potentials which 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. Suitable precautions must be taken to protect test personnel and apparatus because of the high potentials used.

1.3 Factors affecting use. Dielectric behavior of gases, oils, and solids is affected in various degrees by many factors, such as atmospheric temperature, moisture, and pressure; condition and form of electrodes; frequency, waveform, rate of application, and duration of test voltage; geometry of the specimen; position of the specimen (particularly oil-filled components); 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 tests may be extremely difficult.

2. APPLICABLE DOCUMENTS

This section not applicable to this standard.

3. DEFINTIONS

This section not applicable to this standard.

4. GENERAL REQUIREMENTS

4.1. Apparatus.

4.1.1 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 hertz 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 kilovolt-ampere 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 kilovoltampere rating is required, it shall be specified. When a direct potential is specified, the ripple content shall not exceed 5 percent rms of the test potential. When required, a suitable current-limiting device shall be used to limit current surges to the value specified.

4.1.2 Voltage measuring device. A voltmeter shall be used to measure the applied voltage to an accuracy of at least 5 percent, 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 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.

4.1.3 Leakage current measuring device. 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 percent of the specified requirement.

4.1.4 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 4.1.2, the leakage current measuring device of 4.1.3, or an appropriate indicator light or an overload protective device may be used for this purpose.

4.2. Procedure

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

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

4.2.3 Points of application. The test voltage shall be applied between mutually insulated portions of the specimen or between insulated portions and ground as specified. The method of connection of the test voltage to the specimen should be specified only when it is a significant factor.

4.2.4 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.

4.2.5 Duration of application. Unless otherwise specified, the test voltage shall be maintained at the specified value for a period of 60 seconds for qualification testing. For inplant quality conformance testing, when specified, reduced time with a possible correlated higher test voltage may be used. Specimens with movable parts shall be tested as specified, in a manner to assure that repeated stresses are not applied to the same dielectric. Upon completion of the test, the test voltage shall be gradually reduced to avoid surges. At the option of the manufacturer, the test voltage may be removed instantaneously during inplant quality conformance testing.

4.2.6 Examination and measurement of specimen. During the dielectric withstanding voltage test, the fault indicator shall be monitored for evidence of disruptive discharge and leakage current. Following this, the specimen shall be examined and measurements shall be performed to determine the effect of the dielectric withstanding voltage test on specific operating characteristics, when specified.

5. DETAILED REQUIREMENTS

5.1 Summary. The following details are to be specified in the individual specification:

a. Special preparations or conditions, if required (see 4.2.1).

b. Magnitude of test voltage (see 4.2.2).

(1) Test voltage, and duration for inplant quality conformance testing, if different than for qualification testing (see 4.2.5).

c. Nature of potential (ac or dc) (see 4.1.1).

d. Duration of application of test voltage for qualification testing if other than 60 seconds (see 4.2.5).

e. Points of application of test voltage (see 4.2.3).

(1) Method of testing specimens with movable parts (see 4.2.5).

f. Method of connection of test voltage to specimen, if significant (see 4.2.3).

g. Regulation, when applicable (see 4.1.1).

h. Minimum kilovolt-ampere rating of high voltage source, if required. (see 4.1.1).

i. Limiting value of surge current, if applicable (see 4.1.1).

j. Maximum leakage current requirement, if applicable (see 4.1.3).

k. Measurements after dielectric withstanding voltage test, if required (see 4.2.6).

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Supersession data. The main body and 38 parts of this revision of MIL-STD-202 replace superseded MIL-STD-202.

Custodians:
Army - CR
Navy - EC
Air Force - 85
DLA - CC

Preparing activity:
DLA – CC

(Project 59GP-2015-031)

Review activities:
Army - AR, AT, AV, CR4, MI, SM, TE
Navy - AS, OS, SH
Air Force - 19, 99
NSA - NS

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