TC 20

INTERNATIONAL STANDARD ISO 2678

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Environmental tests for aircraft equipment — Part 4.3 : Insulation resistance and high voltage tests for electrical equipment

Essais en environnement pour les équipements aéronautiques — Partie 4.3 : Essais de résistance d'isolement et de haute tension pour les équipements électriques

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2678 was developed by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, and was circulated to the member bodies in September 1976.

It has been approved by the member bodies of the following countries :

Australia	Italy	Spain
Austria	Japan	Turkey
Belgium	Korea, Rep. of	United Kingdom
Canada	Mexico	U.S.A.
Chile	Philippines	U.S.S.R.
Czechoslovakia	Poland	Yugoslavia
Germany	Romania	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

France
Sweden

This International Standard is part of a composite standard, specifying environmental tests for aircraft equipment, which will be published as a number of separate parts, details of which are given in ISO 2650.

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0 INTRODUCTION

The operational safety of electrical equipment for aircraft requires a good quality of insulation and the avoidance of excess voltages. Dimensions and quality of the insulation have to be suitable for the operating voltages and the effects of climatic conditions encountered, such as temperature, humidity, atmospheric pressure and surface contamination. The trend to smaller and safer designs can only be realized if the physical properties and the behaviour of the insulation are known and proven by accurate test procedures.

Insulation resistance measurements and high voltage testing have to be considered as two different tests. A high insulation resistance alone does not prove that the insulation is free from defects : cracks, for instance, may exist, provoking voltage flash-overs.

0.1 Purpose of high voltage test

The high voltage test serves to prove the capability of the insulation to withstand the effects induced by an electrical field.

0.2 Purpose of insulation resistance measurements

Insulation resistance measurements serve to prove that electrical equipment has an adequate insulation resistance capable of preventing leakage currents passing through the insulation from reaching non-permitted values; this applies especially to maintaining the insulation properties under the effects of climatic conditions, such as temperature, humidity and surface contamination.

0.3 Purpose of leakage current measurements

This type of measurement may be applied to equipment where semi-conductors are used. The test voltage is dependent on the rated voltage of the component.

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies requirements for tests to determine the electrical insulation resistance of equipment intended for use in aircraft, together with a high voltage test. It relates the insulation requirements to four categories of equipment.

This International Standard does not relate to the insulation testing of equipment installed in aircraft.

2 REFERENCE

ISO 2650, *Environmental tests for aircraft equipment — Part 1 : Scope and applicability.*

3 DEFINITIONS

3.1 means of insulation : The gaseous, liquid or solid material constituting the insulation.

3.2 insulation : The total of the insulation material in its final technical form.

3.3 insulation capability : The capability of withstanding all voltages up to the appropriate test voltage level.

3.4 rated voltage : The voltage specified in the electrical equipment identification and to which certain operating characteristics are related.

4 REQUIREMENTS

4.1 High voltage

The high voltage test shall be detailed in the relevant equipment specification. The requirements for an adequate insulation capability shall be deemed to be met when the insulation withstands the test voltages specified in table 1. In the case of a repetition of the high voltage test, only 80 % of the test voltage of table 1 shall be applied. The same applies to used or repaired equipment.

High voltage tests shall not be performed on equipment incorporating semi-conductors which cannot be disconnected from their electrical connections or bridged, and which would therefore be destroyed.

4.1.1 *Voltage values*

All a.c. voltages stated are r.m.s. voltages, the testing being carried out under standard sea level conditions.

TABLE 1 — **Minimum values for high voltage tests**

Rated voltage	Test voltage	Duration
28 V, d.c.	500 V, 50 to 60 Hz	1 min
115/200 V, a.c.	1 000 V, 50 to 60 Hz	1 min
28 V, d.c.	600 V, 50 to 60 Hz	5 to 10 s
115/200 V, a.c.	1 500 V, 50 to 60 Hz	5 to 10 s

4.2 Insulation resistance

The requirements for an adequate insulation resistance shall be detailed in the relevant equipment specification. They shall be deemed to be met when the minimum values of table 2 are obtained.

4.3 Leakage current

The requirement for a sufficiently small leakage current shall be deemed to be met when it does not exceed 3 μA.

5 TESTING

5.1 High voltage test

The test shall be performed utilizing sinusoidal a.c. voltage.

The voltage shall be increased continuously from zero to the value specified in table 1 and shall be maintained for the test duration indicated. Thereafter the voltage shall be decreased to zero. The rate of voltage variation shall not exceed 500 V/s. The test voltage shall be applied between the terminals of the equipment and its case (earth), and between other parts as specified in the relevant equipment specification.

5.2 Insulation resistance test

The test voltage shall be 500 ± 25 V, d.c. The insulation resistance shall be measured between live parts as well as between live parts and case (earth). Insulation resistance measurements shall only be taken after the measuring indicator has stabilized.

5.3 Leakage current measurements

A pure d.c. source, for example a battery, shall be used for the measurements. The test voltage shall be 28 V ± 2 V, d.c. A 0,5 MΩ resistor shall be connected in series with the test voltage source.

The leakage current of the equipment, sub-assembly, card, including all components, shall be measured between :

a) individual circuits not normally connected together, and

b) the case (earth) and all live parts connected together.

TABLE 2 — **Minimum values for insulation resistance**

Category	Equipment	Insulation resistance (minimum values) between live parts and case (earth), and between live parts MΩ	
		In conjunction with climatic tests[1]	In conjunction with non-climatic tests
A	Wiring components (terminal blocks, connectors, selectors, limit switches, circuit-breakers, relay contacts or contactors)	50	100
B	Rotating machinery	0,5	20
C	Equipment incorporating electronic components	2	10[2]
D	Indicating instruments and equipment other than those in categories A, B or C	5	20

1) The climatic tests referred to are listed in ISO 2650.

2) When measuring the insulation resistance of individual assemblies, the minimum value shall be increased to 50 MΩ.

6 TEST REPORT

A test report shall be supplied listing the following items, making reference to the relevant clauses, where appropriate, of this International Standard :

a) type, designation, standard of the electrical equipment;

b) associated electrical diagrams;

c) test and/or measuring method;

d) test voltage, measuring voltage, dwell time;

e) measuring equipment and facilities utilized, with stock number and date of last calibration;

f) ambient temperature and relative humidity during test;

g) test results and measured values;

h) other observations;

i) test date;

j) signature of the person responsible for the test.