SLOVENSKI STANDARD
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Aerospace series - Testing of aircraft wiring

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Luft- und Raumfahrt - Prüfung der Verkabelung von Luftfahrzeugen

Série aérospatiale - Vérification des câblages d'aéronefs

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This European Standard was approved by CEN on 1995-08-31. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Foreword

This European Standard has been prepared by the European Association of Aerospace Manufacturers (AECMA).

After inquiries and votes carried out in accordance with the rules of this Association, this Standard has successively received the approval of the National Associations and the Official Services of the member countries of AECMA, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 1996, and conflicting national standards shall be withdrawn at the latest by July 1996.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

0 Introduction

Due to the diversity of aircraft, manufacturing and installing methods for wiring, the tests defined in 1 are carried out at different stages in the manufacturing programme :

- after assembly of cables into bundles before installation in the aircraft;
- after installation of bundles into the aircraft;
- after repairs or modifications.

1 Scope

This standard specifies :

- the tests for finished wiring, including connectors and, if necessary, terminals, terminal ends, junction boxes, circuit breakers, etc.
  These tests do not concern equipment installed in the aircraft (see ISO 2678), the operation of systems and do not apply to the wiring used for "flight test instrumentation";
- the requirements for verification of aircraft electrical wiring :
  - continuity of circuits ;
  - voltage strength ;
  - insulation resistance.

2 Normative references

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

ISO 2678	Environmental tests for aircraft equipment - Insulation resistance and high voltage tests for electrical equipment
IEC 50(461)	International Electrotechnical Vocabulary - Chapter 461 : Electric cables
IEC 50(581)	International Electrotechnical Vocabulary - Chapter 581 : Electromechanical components for electronic equipment
EN 2282	Aerospace series - Characteristics of aircraft electrical supplies

3 Terminology

See IEC 50(461) and IEC 50(581).

4 Tests

For all the tests, the national safety regulations shall be observed.

These tests may be carried out manually or on automatic equipment. In this case, the equipment operates with programmable sequences and trip thresholds.

The test shall be stopped as soon as a fault is detected, or the fault shall be memorized.

The voltage shall increase or decrease in a regular manner to each of the scheduled values and the measurements shall be made after stabilization.

Test equipment is capable of performing the voltage strength and the insulation resistance tests in a single operation, according to the requirements laid down in table 2.

4.1 Continuity

The test makes it possible to verify the conformity of cables and their connections with the design documents.

The direct current or alternating current voltage shall not exceed 28 V.

The value of the current passed shall not cause damage to any part of the circuits.

4.2 Voltage strength

The test makes it possible to verify that the insulation can withstand the voltage (limits) given in EN 2282.

The voltage shall not be suddenly applied to the circuits ; this will avoid damaging cables.

When the permitted leakage current is exceeded, the warning or protection system shall operate to avoid damage to the components being tested.

It should be noted that in alternating current tests, the capacitive leakage currents add (vectorially) to the fault currents detected.

After each voltage strength test, the measurement point shall be grounded in order to discharge the circuit (except when this circuit remains connected to the reference point).

4.3 Insulation resistance

The test makes it possible to verify the insulation resistance of the wiring.

The voltages used for these measurements are between 50 V and 500 V direct current. The fault current shall not exceed 5 mA (for a short-circuit).

The measurement shall not be made until voltage and current stabilization is achieved.

4.4 Test preparation

The conductors and screens of screened or coaxial cables shall be tested in the same way as single core cables, provided they are accessible at both ends.

The screened cable test, with respect to the ground, shall be carried out before the screens are grounded.

The connector shells covered with conducting protection or other conductive supports shall be grounded.

Electronic components housed in junction boxes shall be short-circuited or disconnected.

Connectors, switches, circuit-breakers, etc. can be left in circuit provided that they can withstand the test. Otherwise the test voltage shall be decreased.

No equipment shall be connected.

The parts of circuits having already been brought into contact with flammable liquids or hydraulic fluids shall only be tested when the national safety regulations are observed, so as to avoid any risk of explosion or fire.

5 Procedures

The types of wiring, the systems to which they belong and their functions require several categories (see table 1).

Table 1

Categories	Description
A	All wiring apart from specific cases dealt with under B or C
B	Specific circuits for each type of aircraft to be defined by mutual agreement between manufacturers and authorities
C	Screened wiring, in principle isolated from the ground for tests, before being connected to the ground

Aircraft wiring presenting installation difficulties and wiring in military aircraft shall be subject to inspection after installation (table 2, part II).

Table 2

Part I - Tests after manufacture (prior to installation in aircraft)				
Tests	Characteristics	Categories (see table 1)		
		A	B	C
Voltage strength	-	1 000 V a.c. [2] or 1 300 V d.c.	380 V a.c. [2] or 500 V d.c.	40 V a.c. [2] or 50 V d.c.
	Minimum application time	1 s	0,1 s	0,1 s
Minimum insulation resistance	Measuring voltage (±10 %)	500 V d.c.	500 V d.c.	50 V d.c.
	RH [1] ≤ 70 %	20 MΩ	50 MΩ	10 MΩ
Part II - Tests of assembled bundles (after installation in aircraft)				
Tests	Characteristics	Categories (see table 1)		
		A	B	C
Voltage strength	-	1 000 V a.c. [2] or 1 300 V d.c.	380 V a.c. [2] or 500 V d.c	40 V a.c [2] or 50 V d.c.
	Application time	0,1 s to 1 min	0,1 s to 1 min	0,1 s to 1 min
Minimum insulation resistance	Measuring voltage (±10 %)	500 V d.c.	500 V d.c.	50 V d.c.
	RH [1] ≤ 70 %	10 MΩ	20 MΩ	2 MΩ
	RH [1] 70 % to 80 %	5 MΩ	10 MΩ	1 MΩ
1) Relative humidity 2) Root mean square, frequency 50 Hz to 60 Hz				

All the tests for wiring shall take place before the connection of equipment.

Electrical and electronic components connected within the wiring shall not be exposed to voltages and currents which could damage them (see 4.4).

Voltage strength and insulation resistance tests shall be carried out between each conductor and any other conductor, and between each conductor and earth (structure). See table 2 for conditions and requirements.

Tests on pre-assembled wiring shall comply with the requirements in 5.1 and the requirements of table 2, part I.

Tests on finished wiring (assembled and installed) shall comply with the requirements of 5.2 and the requirements of table 2, part II.

5.1 Testing of wiring in production

5.1.1 Continuity

The test shall be carried out successively on each section of the circuit, suitably established by the control units (switches, isolators, etc.).

The purpose of the test is not to measure possible voltage drop on line, since this is covered by the functional tests (see EN 2282).

5.1.2 Voltage strength

See table 2, part I. The aircraft test specification shall state the value to be applied or the specific circuits to be subjected to the relevant requirements.

The choice of direct current or alternating current can depend on the test devices or national requirements.

The use of direct current is recommended and is necessary where the circuit capacity causes leakage currents affecting measurements.

5.2 Testing of assembled and installed bundles

Perform the tests of 5.1.

The applicability of these tests, either on the complete aircraft or sub-assemblies, and the specific circuits are defined in the aircraft test specification.

The tests are usually carried out by automatic test equipment which combines the voltage strength test and insulation resistance measurements.

For tests which are to be repeated, in-service inspection, repair, etc., the voltage values in part II of table 2 shall apply with a possible coefficient of reduction (for example 0,8).

All the conductors affected by modifications or repairs on a wiring shall be tested.

When screens and certain return conductors are finally connected to the aircraft structure, they shall be considered as earth and shall no longer be disconnected. Then they will only be subject to continuity tests.