SLOVENSKI STANDARD

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Aerospace series - Cables, electrical, aircraft use - Test methods - Part 705: Contrast measurement

Luft- und Raumfahrt - Elektrische Leitungen für Luftfahrtverwendung - Prüfverfahren - Teil 705: Kontrastmessung

Série aérospatiale - Câbles électriques à usage aéronautique - Méthodes d'essais - Partie 705 : Mesure de contraste

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English Version

Aerospace series - Cables, electrical, aircraft use - Test methods - Part 705: Contrast measurement

Série aérospatiale - Câbles électriques à usage aéronautique - Méthodes d'essais - Partie 705 : Mesure de contraste

Luft- und Raumfahrt - Elektrische Leitungen für Luftfahrtverwendung - Prüfverfahren - Teil 705: Kontrastmessung

This European Standard was approved by CEN on 12 September 2005.

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This European Standard exists 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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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This European Standard (EN 3475-705:2005) has been prepared by the European Association of Aerospace Manufacturers - Standardization (AECMA-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has 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of an identical text or by endorsement, at the latest by April 2006, and conflicting national standards shall be withdrawn at the latest by April 2006.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This European Standard supersedes EN 3475-705:2002.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

It is a requirement within the aerospace industry that all wires and cables within an aircraft electrical system are identified with a circuit identification code at regular intervals down the length of the wire. Various marking methods are used for marking these identification codes on to the surface of electrical wires or cables including ink based and laser based processes. The legibility of the markings is dependent upon the process used and the insulation medium. Minimum standards of contrast are required to facilitate reading back of the identity codes.

1 Scope

This standard specifies the process to be applied for measuring the contrast of wire and cable identification markings against the background of the unmarked wire insulation. It has been developed primarily to define a reproducible process of contrast value determination for use both to determine the intrinsic laser markability of wires at the time of manufacture or later, and to enable electrical wiring systems manufacturers to ensure that the whole process of wire marking is carried out to the required standard.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7724-1, *Paints and varnishes — Colorimetry — Part 1: Principles.*

EN 3475-706, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 706: Laser markability.*

IEC 15-2, *Colorimetry.*

TR 4543, UV *laser wire marking systems for aircraft wire and cable identification.*[1)]

1) In preparation at the date of publication of this standard.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
contrast
the ratio of the difference in luminance between the marked and unmarked areas of the insulation divided by the luminance of the unmarked insulation

3.2
luminance
the quantitative measurement of the visible light reflected from a surface, in this case the wire or cable insulation

3.3
laser
laser is an acronym for Light Amplification by the Stimulated Emission of Radiation.

Lasers are a source of intense monochromatic light in the ultraviolet, visible or infrared region of the spectrum.

3.4
ultraviolet (abbreviation UV)
electromagnetic radiation in a wavelength range from approximately 200 nm to 400 nm

3.5
UV laser
a laser that produces a beam of UV radiation

3.6
fluence
the energy density, measured in J cm^{-2} (Joules per square cm) of a single pulse of the laser beam, which, for the purposes of this document, is taken at the surface of the wire insulation or cable jacket

3.7
wavelength
wavelength (λ) is measured in nanometres, nm. 1 nm = 10^{-9} m. $\lambda = c/f$ where c is the velocity of light and f is the frequency

4 Preparation of samples

The wire or cable samples shall be identified in accordance with the applicable manufacturing instructions for the marking equipment. Where samples are to be UV laser marked this shall be done using the fluence specified in TR 4543 or the relevant wire or aircraft manufacturer's process specification if different. When determining the laser markability of wires, this shall be in accordance with EN 3475-706.

Take a sample of the wire for marking. Before marking the wire ensure that the wire surface is clean and dry and free from dust and dirt; if necessary wipe it clean using propan-2-ol (isopropyl alcohol). The surfaces of the samples shall be clean and without damage.

The identification markings to be measured shall be even in colour and characters shall have well defined edges.

Before starting measurements clean the surfaces with a soft, lint-free cloth, if required, to avoid distortion of test results by a roughened surface or "deposits".

5 Apparatus, measurement and process

5.1 Apparatus

5.1.1 Components of the measuring device

The measuring device shall comprise, at a minimum, a photometer, an illumination system and a purpose designed sample holder suitable for wire and cable. The whole system shall be designed to ensure that test results are not falsified by external influences. The photometer shall be designed to be stable and free from vibrations and to exclude the influences of external light and reflections from scattered light.

5.1.2 Equipment colour

The device for holding samples and any accessories and the equipment in the vicinity of the measurement area shall be matt black in colour to absorb scattered light.

5.1.3 Photometer

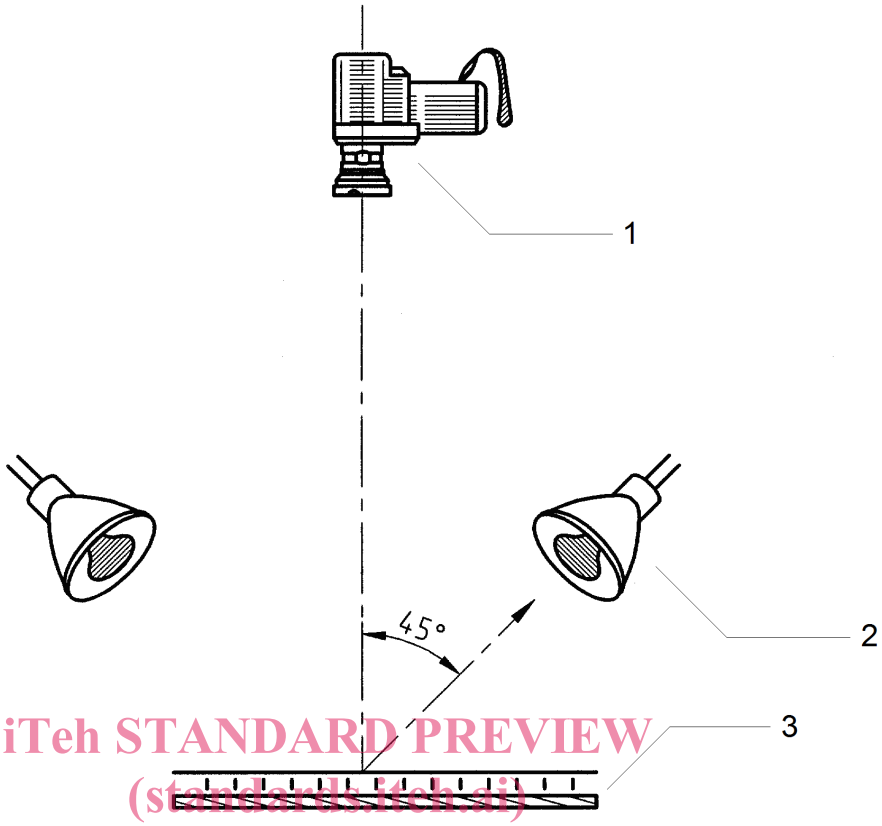
The luminance shall be determined with a calibrated electrical photometer, which shall incorporate a photopic filter to simulate the response of the human eye. The manufacturer's instructions concerning the photometer working range and operating instructions shall be observed. The measurement sensitivity of the photometer shall be in conformity with IEC publication 15-2.

5.1.4 Illumination and viewing system

The illumination system shall consist of two light sources of equal intensity (see Figure 1). The two sources may be two separate lamps or, preferably, two fibre light guides fed from a single lamp. The light from the sources shall overlap to illuminate a central spot on the sample at an angle of 45° to the surface. The light cones shall illuminate the wire sample longitudinally along its length and in a manner to avoid the formation of shadows. The photometer must be installed to view the sample along the normal to the surface, i.e. at 90°, and above the principal focus at a distance that depends on the objective's focal distance. It shall be adjusted during calibration and after every change of objective.

If two separate lamps are used they shall be of identical power consumption and shall always be exchanged in pairs. The radiating light energy and colour temperature of the lamps shall be compatible with the working range of the photometer, according to the manufacturer's instructions. The spectral distribution of the light shall be close to artificial light specifications according to light standard A, ISO 7724-1. Only gas filled lamps with tungsten filaments shall be used. The colour temperature shall be (3 000 ± 500) K.

The voltage supply for the lamps shall be insensitive to line fluctuations. A stabilised d.c. power unit shall be used.



Key

1 Photometer
2 Source of light
3 Marked cable

Figure 1 — Lighting equipment

5.2 Measurement

5.2.1 Equipment design and measurement methodology

To determine the contrast, measurements must be taken of the luminance from both marked and unmarked areas of the insulation. Depending upon the contrast measurement equipment design, the photometer may be used either to take a series of individual point measurements sequentially or it may determine the contrast instantaneously by the simultaneous measurement of the luminance of all the sample points of an area of the sample. If a point measurement system is used, sufficient points shall be sampled on both the marked and unmarked portion of the wire to ensure that a good average value of the reflectance of each is obtained.

5.2.2 Measurement spot size

The maximum admissible diameter of the photometer measurement spot shall be not in excess of 75 % of the character stroke width. This is particularly important if using a point measurement system where spot sizes are typically relatively large.

5.2.3 Measurement area

The contrast shall be measured over a finite area to include a significant portion of the marked and the unmarked surface of the wire.