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Aerospace series - Fibre optic systems - Handbook - Part 002: Test and measurement

Táto norma obsahuje anglickú verziu európskej normy.  
This standard includes the English version of the European Standard.

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Handbuch - Teil 002: Tests und Messungen

This European Standard was approved by CEN on 23 July 2017.

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**EN 4533-002:2017 (E)**

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## **European foreword**

This document (EN 4533-002:2017) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-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 ASD, 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of an identical text or by endorsement, at the latest by June 2018 and conflicting national standards shall be withdrawn at the latest by June 2018.

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

This document supersedes EN 4533-002:2006.

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

**EN 4533-002:2017 (E)****Introduction****a) The Handbook**

This handbook aims to provide general guidance for experts and non-experts alike in the area of designing, installing, and supporting fibre-optic systems on aircraft. Where appropriate more detailed sources of information are referenced throughout the text.

It is arranged in 4 parts, which reflect key aspects of an optical harness life cycle, namely:

Part 001: Termination methods and tools

Part 002: Test and measurement

Part 003: Looming and installation practices

Part 004: Repair, maintenance, cleaning and inspection

**b) Background**

It is widely accepted in the aerospace industry that photonic technology significant advantages over conventional electrical hardware. These include massive signal bandwidth capacity, electrical safety, and immunity of passive fibre-optic components to the problems associated with electromagnetic interference (EMI). Significant weight savings can also be realized in comparison to electrical harnesses which may require heavy screening. To date, the EMI issue has been the critical driver for airborne fibre-optic communications systems because of the growing use of non-metallic aerostructures. However, future avionic requirements are driving bandwidth specifications from 10's of Mbits/s into the multi-Gbits/s regime in some cases, i.e. beyond the limits of electrical interconnect technology. The properties of photonic technology can potentially be exploited to advantage in many avionic applications, such as video/sensor multiplexing, flight control signalling, electronic warfare, and entertainment systems, as well as sensor for monitoring aerostructure.

The basic optical interconnect fabric or 'optical harness' is the key enabler for the successful introduction of optical technology onto commercial and military aircraft. Compared to the mature telecommunications applications, an aircraft fibre-optic system needs to operate in a hostile environment (e.g. temperature extremes, humidity, vibration, and contamination) and accommodate additional physical restrictions imposed by the airframe (e.g. harness attachments, tight bend radii requirements, and bulkhead connections). Until recently, optical harnessing technology and associated practices were insufficiently developed to be applied without large safety margins. In addition, the international standards did not adequately cover many aspects of the life cycle. The lack of accepted standards thus lead to airframe specific hardware and support. These factors collectively carried a significant cost penalty (procurement and through-life costs), that often made an optical harness less competitive than an electrical equivalent. This situation is changing with the adoption of more standardized (telecoms type) fibre types in aerospace cables and the availability of more ruggedized COTS components. These improved developments have been possible due to significant research collaboration between component and equipment manufacturers as well as the end use airframers.

## **1 Scope**

This handbook examines the requirements to enable accurate measurement of fibre optic links from start of life and during the life cycle of the system from installation and through-service. Part 2 will explain the issues associated with optical link measurement and provide techniques to address these issues. This document discusses the measurement of key parameters associated with the passive layer (i.e. transmission of light through an optical harness). It does not discuss systems tests e.g. bit error rates.

## **2 Normative references**

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

EN 2591-601, *Aerospace series — Elements of electrical and optical connection — Test methods — Part 601: Optical elements — Insertion loss*

EN 4533-001, *Aerospace series — Fibre optic systems — Handbook — Part 001: Termination methods and tools*

EN 4533-003, *Aerospace series — Fibre optic systems — Handbook — Part 003: Looming and installation practices*

EN 4533-004, *Aerospace series — Fibre optic systems — Handbook — Part 004: Repair, maintenance, cleaning and inspection*

**koniec náhľadu – text ďalej pokračuje v platenej verzii STN**