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

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

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English Version

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

Série aérospatiale - Systèmes des fibres optiques - Manuel d'utilisation - Partie 004 : Réparation, maintenance, nettoyage et contrôle

Luft- und Raumfahrt - Faseroptische Systemtechnik - Handbuch - Teil 004: Reparatur, Wartung und Inspektion

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Contents Page

European foreword ... 3
Introduction ... 4
1 Scope ... 5
2 Normative references ... 5
3 Fault analysis ... 6
3.1 Fault notification ... 6
3.2 Symptoms ... 6
3.3 Potential faults ... 7
3.4 Fault identification and location ... 10
4 Repair techniques ... 13
4.1 General ... 13
4.2 Splice ... 13
4.3 Structural repair ... 14
4.4 Terminus recovery ... 14
5 Inspection and cleaning ... 16
5.1 End face inspection ... 16
5.2 Cleaning ... 20
6 Scheduled maintenance and inspection ... 24
6.1 When to maintain/Inspect? ... 24
6.2 Maintenance/Inspection of system ... 25
6.3 Maintenance/Inspection of components ... 26
Annex A (normative) Termini end face contamination ... 27
Annex B (normative) Cleaning Methods ... 32
B.1 Method 1 ... 32
B.2 Method 2 ... 34

European foreword

This document (EN 4533-004:2018) 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of an identical text or by endorsement, at the latest by July 2018 and conflicting national standards shall be withdrawn at the latest by July 2018.

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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

The handbook gives guidelines related to 'Fault analysis and repair' as well as 'maintenance and inspection of fibre optic links. The first deals with what to do when something goes wrong – how to go from a fault notification to locating the fault, and finally, repairing it. The second covers the recommended procedures for upkeep and maintaining harness health over the lifetime of its installation.

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

EN 4533-002, *Aerospace series — Fibre optic systems — Handbook — Part 002: Test and measurement*

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

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

EN 3733 (all parts), *Aerospace series — Connector, optical, circular, single channel, coupled by self-locking ring, operating temperature up to 150 °C continuous*

EN 4531-101, *Aerospace series — Connectors, optical, circular, single and multipin, coupled by threaded ring — Flush contacts — Part 101: Optical contact for EN 4641-100 cable – 55 °C to 125 °C — Product standard*

EN 4639-101, *Aerospace series — Connectors, optical, rectangular, modular, multicontact, 1,25 diameter ferrule, with removable alignment sleeve holder — Part 101 : Optical contact for cable EN 4641-100 — Operating temperatures between – 65 °C and 125 °C — Product standard*

EN 4645 (all parts), *Aerospace series — Connectors, optical, circular, single and multipin, coupled by threaded ring, self-locking 1,25 mm diameter ferrule with removable alignment sleeve holder*

IEC 60825-1, *Safety of laser products — Part 1: Equipment classification, requirements and user's guide*

IEC 61300-3-35, *Fibre optic interconnecting devices and passive components — Basic test and measurement procedures — Part 3-35: Examinations and measurements — Visual inspection of fibre optic connectors and fibre-stub transceivers*

ARINC 805, *Harsh environment fibre optic connectors/testing*

SAE-AS5675, *Characterization and requirements for new aerospace fibre optic cable assemblies — Jumpers, end face geometry, link loss measurement, and inspection*

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