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Part 004: Packaging

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Foreword

This document (EN 4660-004:2011) 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of an identical text or by endorsement, at the latest by August 2011, and conflicting national standards shall be withdrawn at the latest by August 2011.

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0 Introduction

0.1 Purpose

This document is produced under contract ASAAC Phase II Contract n°97/86.028.

The purpose of the ASAAC Programme is to define and validate a set of open architecture standards, concepts and guidelines for Advanced Avionics Architectures (A3) in order to meet the three main ASAAC drivers. The standards, concepts and guidelines produced by the Programme are to be applicable to both new aircraft and update programmes from 2005.

The three main goals for the ASAAC Programme are:

1. Reduced life cycle costs.

2. Improved mission performance.

3. Improved operational performance.

The ASAAC standards are organised as a set of documents including:

A set of agreed standards that describe, using a top down approach, the Architecture overview to all interfaces required to implement the core within avionics system.

The guidelines for system implementation through application of the standards.

The document hierarchy is given hereafter: *(in this figure the document is highlighted)*

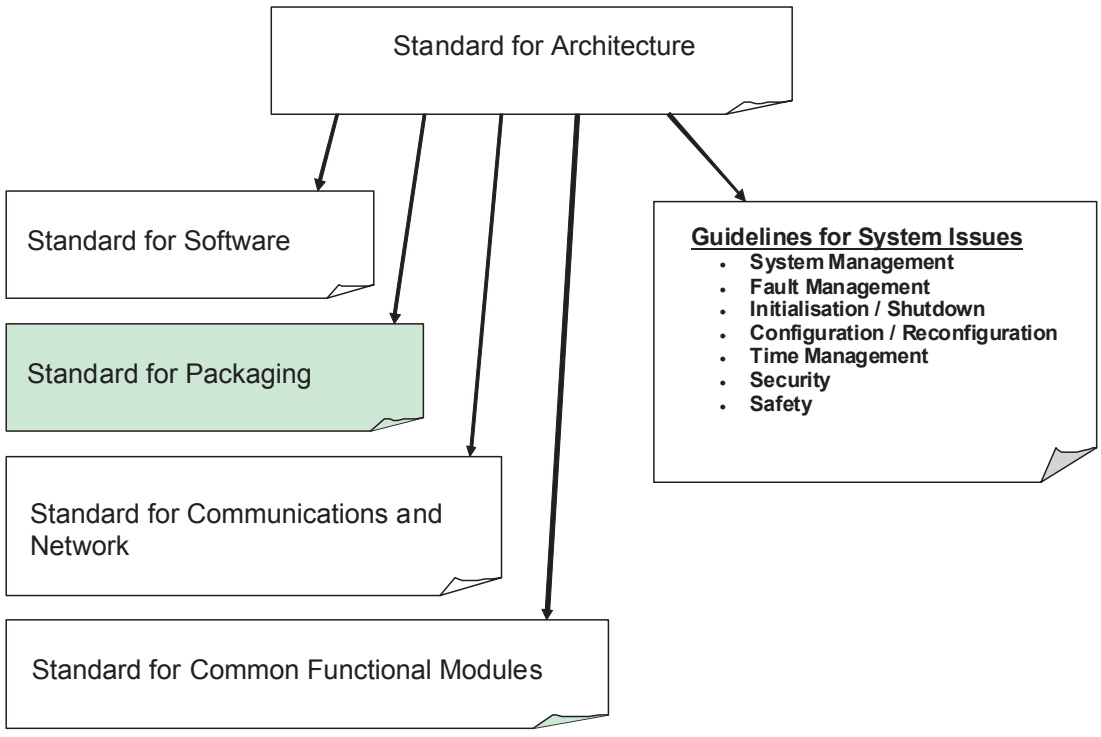

Figure 1 — ASAAC Standard Documentation Hierarchy

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0.2 Document structure

The document contains the following clauses:

Clause 1, Scope.

Clause 2, Normative references.

Clause 3, Terms, definitions and abbreviation.

Clause 4, Generic module specification.

Clause 5, Module Mechanical Tests.

Clause 6, Guidelines for a rack slot.

Clause 7, Typical modular avionics environment.

1 Scope

The purpose of this standard is to establish uniform requirements for Packaging for the Common Functional Modules (CFM) within an Integrated Modular Avionic (IMA) system, as defined per ASAAC. It comprises the module physical properties and the Module Physical Interface (MPI) definitions together with guidelines for IMA rack and the operational environment.

The characteristics addressed by the Packaging Standard are:

Interchangeability:

— For a given cooling method all modules conforming to the packaging standard will function correctly when inserted into any rack slot conforming to the standard for the cooling method.

— All modules conforming to the Module Physical Interface (MPI) definitions for connector, IED and cooling interface will function correctly when inserted into any rack slot conforming to the same MPI definition.

Maintainability:

— All modules are easily removable at first line.

— No special tools required at first line.

— No manual adjustment is necessary when installing modules. No tool is required for installation or removal of the modules.

— Mechanical keying is provided that prevents insertion of a module into a rack slot that may cause an unsafe condition.

The Module Physical Interface definition, contained within this standard, does not include the properties of the signalling used in the optical interface (e.g. wavelength). These are covered in EN 4660-003.

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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.

EN 2101, *Aerospace series — Chromic acid anodizing of aluminium and wrought aluminium alloys*

EN 2284, *Aerospace series — Sulphuric acid anodizing of aluminium and wrought aluminium alloys*

EN 2437, *Aerospace series — Chromate conversion coatings (yellow) for aluminium and aluminium alloys*

EN 4660-001, *Aerospace series — Modular and Open Avionics Architectures — Part 001: Architecture*

EN 4660-002, *Aerospace series — Modular and Open Avionics Architectures — Part 002: Common Functional Modules*

EN 4660-003, *Aerospace series — Modular and Open Avionics Architectures — Part 003: Communications/Network*

EN 4660-005, *Aerospace series — Modular and Open Avionics Architectures — Part 005: Software*

ASAAC2-GUI-32450-001-CPG Issue 01, *Final Draft of Guidelines for System Issues* [1)]

— *Volume 1 — System Management.*

— *Volume 2 — Fault Management.*

— *Volume 3 — Initialisation and Shutdown.*

— *Volume 4 — Configuration / Reconfiguration.*

— *Volume 5 — Time Management.*

— *Volume 6 — Security.*

— *Volume 7 — Safety.*

ARINC 600, *Air transport avionics — Equipment interfaces.*

Def Stan 03-18, *Chromate Conversion Coatings (Chromate Filming Treatments) Grades: Standard and Brushing for Aluminium and Aluminium Alloys.*

Def Stan 03-24, Chromic Acid Anodizing of Aluminium and Aluminium Alloys.

Def Stan 03-25, Sulphuric Acid Anodizing of Aluminium and Aluminium Alloys.

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

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BS 5599, *Specification for hard anodic oxidation coatings on aluminium and its alloys for engineering purposes.* 2)

MIL-C-26074E, *Coatings, Electroless Nickel Requirements.*

MIL-A-8625E, *Anodic Coatings for Aluminium and Aluminium Alloys.*

MIL-C-81706, *Chemical Conversion Materials for Coating Aluminium and Aluminium Alloys.*

MIL-C-5541, *Chemical Conversion Coatings on Aluminium and Aluminium Alloys.*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

Use of “shall”, “should” and “may” within the standards observe the following rules:

— The word SHALL in the text express a mandatory requirement of the standard.

— The word SHOULD in the text expresses a recommendation or advice on implementing such a requirement of the standard. It is expected that such recommendations or advice will be followed unless good reasons are stated for not doing so.

— The word MAY in the text expresses a permissible practice or action. It does not express a requirement of the standard.

3.2 Abbreviations

AFA	Air Flow Around
AFT	Air Flow Through
ARINC	Aeronautical Radio Inc
ASAAC	Allied Standard Avionics Architecture Council
CC	Conduction Cooled
CFM	Common Functional Module
DAF	Direct Air Flow
EMC	ElectroMagnetic Compatibility
IED	Insertion Extraction Device
IMA	Integrated Modular Avionics
MBU	Multiple Bit Upset

2) Replaces Def Stan 03-26.

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MPI	Module Physical Interface
MT	Mechanical Transfer
NBC	Nuclear, Biological and Chemical
PSD	Power Spectral Density
SEU	Single Event Upset

3.3 Precedence

Figures in this document have precedence over text.

3.4 Definition of terms

3.4.1 General terms

Backplane — A structure containing optical and electrical communication paths and electrical power supply wiring between modules. This shall be a removable structure or integrated into the rack.

Cassette — Mechanical frame enclosing the electrical components of the module.

Connector — A device to provide all of the electrical and optical connections between the cassette and the backplane.

The connector fixed to the module cassette plugs into the corresponding connector of the backplane.

It comprises a shell, inserts contacts and ferrules.

Contact — A single signal connection, either an electrical pin/socket or a single fibre. In the case of fibre optic contacts this does not necessarily imply the mating parts are in mechanical contact.

Cooling Interface — Surface which contributes to the removal of heat from the module.

Ferrule — A housing and alignment device for one or more optical fibres.

Insert — A section of a connector containing a number of ferrules or contacts.

Insertion Extraction Device (IED) — A device to aid the insertion and extraction of the module from the rack and give mechanical advantage over the mating forces associated with the connector. It also provides the retention system for the module within the rack such that the module connector remains mated under all conditions specified.

Module — The module is a grouping of electronic devices, assembled together to perform a specific function, into a flight-line protected hardware assembly. This is the Common Functional Module. The CFM is replaceable at first line.

Rack — A mechanical arrangement for housing avionics equipment. This provides physical support, environmental protection and cooling for the modules.

Shell — The outer mating parts of the connector that provide the structure of the connector, fixings to the module and backplane parts and the support for the Inserts.

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3.4.2 Module mechanical items

A Common Functional Module comprises:

— A cassette.

— A connector.

— An insertion extraction device.

The volume of the cassette is delimited by a cuboid. The module is referenced against a Cartesian Reference System as represented on Figure 2.

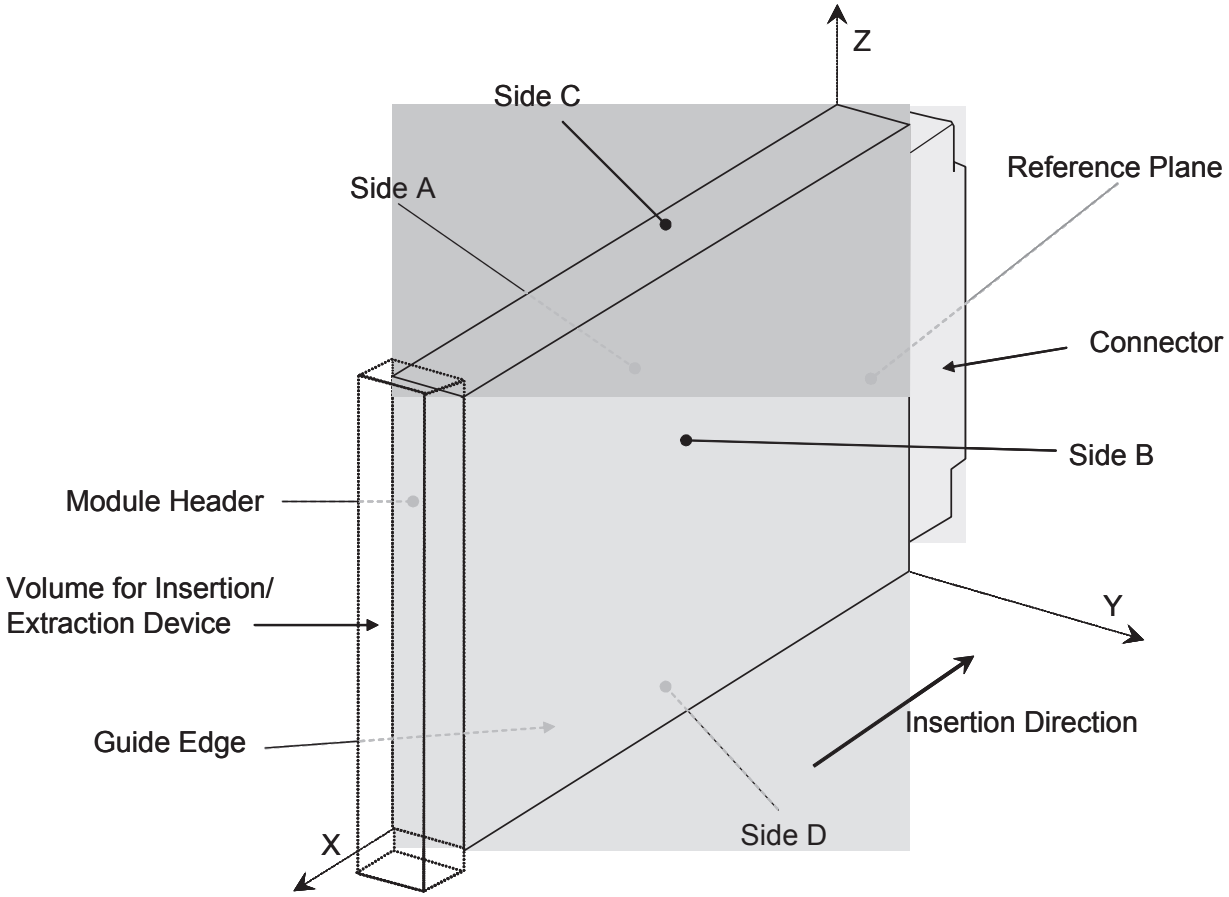

Figure 2 — Module definitions

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Guide Edge	Edge of the CFM running along the X axis. It defines the location of the module within the rack.
Height	The cassette dimension in the Z-axis. It is measured from cassette Side C to cassette Side D.
Length	The cassette dimension in the X-axis measured from the Reference Plane to the module header (this excludes the Insertion Extraction Device and the connector).
Module header	The surface of the cassette parallel to the Reference Plane, and opposite to the cassette surface contained within the Reference Plane The IED shall be mounted on this surface.
Side A	Surface of the cassette contained within the X, Z plane. Viewing the module in the direction of insertion, with the cassette Side C at the top, Side A is to the left.
Side B	Surface of the cassette parallel to and furthest from the X, Z plane. Viewing the module in the direction of insertion, with the cassette Side C at the top, Side B is to the right.
Side C	Surface of the cassette parallel to and furthest from the X, Y plane. It contains one of the two cassette cooling interfaces, the other being within Side D.
Side D	Surface of the cassette contained within the X, Y plane. It contains one of the two cassette cooling interfaces, the other being within Side C.
Reference Plane	Plane defined by the Y and Z axis. It is perpendicular to the direction of insertion of the module and passes through the mating surface between the cassette and the connector.
Width	The cassette dimension in the Y-axis of the module, measured from Side A to Side B.

3.4.3 Tolerances

Unless otherwise stated, tolerances shall be ± 0,2 mm.

4 Generic module specification

4.1 Introduction

This clause specifies the physical properties and the principle physical interfaces for ASAAC Common Functional Modules, i.e. the Module Physical Interface (MPI). The MPI comprises:

— The Connector Interface between Common Functional Module and Backplane.

— The Cooling Interface.

— The Insertion Extraction Device (IED).

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The ASAAC Common Functional Module supports four cooling techniques detailed in 4.5. These being:

— Conduction Cooling (CC).

— Direct Air Flow Cooling (DAF).

— Air Flow Around Cooling (AFA).

— Air Flow Through Cooling (AFT).

This clause specifies those parameters that shall apply to all module types.

In addition, Guidelines for the Module guide to rack slot interfaces compatible with the MPI is provided in Clause 6.

It is assumed that a System Design Specification will be raised for each specific project implementation. It will define the CFM characteristics which are not imposed by the standard.

4.2 Module description

A module consists of an enclosed component mounting area, a connector and an insertion extraction device. The module shall have the following attributes:

— Provision for the protection of electronic devices, contained within the CFM, from the typical environment requirements identified in the Clause 7, both during use and during handling, storage and transportation,

— Provision for a connector which mates with the backplane assembly and provides all power and data links to the rest of the avionics system,

— Provision for a keying method to positively bulk the incorrect insertion of any CFM into a rack and to ensure that an incorrectly fitted CFM shall be prevented from making any electrical connection,

— Provision for a mechanism that retains the module within the rack under the mechanical and environmental conditions specified herein and yet allows for easy insertion and removal of the module,

— Provision for a cooling interface that provides for the removal of heat from the CFM,

— Provision for easy identification.

4.3 Module Physical Specification

4.3.1 Module envelope: height, length, width

The module envelope comprises the IED, the cassette and the connector. The principle dimensions for the cassette are as shown in Figure 3. These dimensions shall be:

— Width: 24 mm +0.0 / -0.2 mm.

— Height: 160 mm +0.0 / -0.2 mm.

— Length: 233.4 mm +0.0 / -0.2 mm.

— Length + Connector: 262.9 mm +0.0 / -0.2 mm.

Detailed dimensions of the connector, IED and mating structure parts are given in 4.4 and 4.6.

The modules shall be capable of being mounted on a pitch of 26 mm (modular).

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