SLOVENSKI STANDARD
SIST EN 9300-100:2018

01-oktober-2018

Aeronavtika - LOTAR - Dolgotrajno arhiviranje in iskanje digitalne tehnične dokumentacije o izdelkih, kot so podatki o 3D, CAD in PDM - 100. del: Splošni pojmi za dolgoročno arhiviranje in pridobivanje CAD 3D mehanskih informacij

Aerospace series - LOTAR - Long Term Archiving and Retrieval of digital technical product documentation such as 3D, CAD and PDM data - Part 100: Common concepts for Long term archiving and retrieval of CAD 3D mechanical information

Luft- und Raumfahrt - LOTAR - Langzeit-Archivierung und -Bereitstellung digitaler technischer Produktdokumentationen, wie zum Beispiel von 3D-, CAD- und PDM-Daten - Teil 100: Allgemeine Konzepte für die Langzeitarchivierung und -Bereitstellung von 3D-CAD-Mechanik-Informationen

Série aérospatiale - LOTAR - Archivage Long Terme et récupération des données techniques produits numériques, telles que CAD 3D et PDM - Partie 100 : Concepts communs pour l'archivage long terme et la récupération des données CAD 3D méchanique

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English Version

Aerospace series - LOTAR - Long Term Archiving and Retrieval of digital technical product documentation such as 3D, CAD and PDM data - Part 100: Common concepts for Long term archiving and retrieval of CAD 3D mechanical information

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Contents

Page

Figures

Page

European foreword

This document (EN 9300-100:2018) 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of an identical text or by endorsement, at the latest by January 2019, and conflicting national standards shall be withdrawn at the latest by January 2019.

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.

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.

Foreword

This European standard was prepared jointly by AIA, ASD-STAN, PDES Inc and the PROSTEP iViP Association.

The PROSTEP iViP Association is an international non-profit association in Europe. For establishing leadership in IT-based engineering it offers a moderated platform to its nearly 200 members from leading industries, system vendors and research institutions. Its product and process data standardization activities at European and worldwide levels are well known and accepted. The PROSTEP iViP Association sees this standard and the related parts as a milestone of product data technology.

PDES Inc is an international non-profit association in USA. The mission of PDES Inc is to accelerate the development and implementation of ISO 10303, enabling enterprise integration and PLM interoperability for member companies. PDES Inc gathers members from leading manufacturers, national government agencies, PLM vendors and research organizations. PDES Inc. supports this European standard as an industry resource to sustain the interoperability of digital product information, ensuring and maintaining authentic longevity throughout their product lifecycle.

Readers of this European standard should note that all standards undergo periodic revisions and that any reference made herein to any other standard implies its latest edition, unless otherwise stated.

The standards will be published under two different standards organizations using different prefixes. ASD-Stan will publish the standard under the number EN 9300–xxx. AIA will publish the standard under the number NAS 9300–xxx. The content in the EN 9300 and NAS 9300 documents will be the same. The differences will be noted in the reference documentation (i.e. for EN 9300 Geometric Dimensioning & Tolerancing will be referenced in ISO 1101 and ISO 16792, and for NAS 9300 the same information will be referenced in ASME Y14.5M and Y 14.41). The document formatting etc, will follow that of the respective editorial rules of ASD-Stan and AIA.

1 Scope

1.1 Introduction

This European Standard defines common fundamental concepts for Long Term Archiving and Retrieval of CAD mechanical information for elementary parts and assemblies. It details the "fundamentals and concepts" of EN 9300-003 in the specific context of Long Term Archiving of CAD mechanical models.

CAD mechanical information is divided into assembly structure and geometrical information, both including explicit and implicit geometrical representation, Geometric Dimensioning and Tolerancing with Form Features.

The EN 9300-1XX family is organized as a sequence of parts, each building on the previous in a consistent way, each adding a level of complexity in the CAD data model. This includes the detailing of relationships between the essential information for the different types of CAD information covered by the EN 9300-1XX family.

As technology matures additional parts will be released in order to support new requirements within the aerospace community.

1.2 In scope

The present part describes:

— the fundamentals and concepts for Long Term Archiving and Retrieval of CAD 3D mechanical information;

— the document structure of the EN 9300-1XX family, and the links between all these parts;

— the qualification methods for long term preservation of archived CAD mechanical information; more specially, principles for the CAD validation properties and for verification of the quality of the CAD archived file;

— specifications for the preservation planning of archived CAD information;

— specific functions for administration and monitoring of CAD archived mechanical models;

— the definition of Archive Information Packages for CAD data.

1.3 Out of Scope

The following are out of scope for this part:

— Long Term Archiving of CAD 2D drawings;

— other CAD business disciplines, such as piping, tubing, electrical harnesses, composite, sheet metal design, kinematics.

This version does not include:

— fundamental and concepts for parts EN 9300-120 version 2, EN 9300-125, 1 EN 9300-130.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 9300 (all parts), *Aerospace series — LOTAR — LOng Term Archiving and Retrieval of digital technical product documentation such as 3D, CAD and PDM data*

ISO 10303-203:2011, *Industrial automation systems and integration — Product data representation and exchange — Part 203: Application protocol: Configuration controlled 3D design of mechanical parts and assemblies*

ISO 10303-214:2010, *Industrial automation systems and integration — Product data representation and exchange — Part 214: Application protocol: Core data for automotive mechanical design processes*

ISO 10303-239:2005, *Industrial automation systems and integration — Product data representation and exchange — Part 239: Application protocol: Product life cycle support*

ISO 16792:2006, *Technical product documentation — Digital product definition data practices*

ISO 1101:2004, *Geometrical product specifications (GPS) — Geometrical tolerancing — Tolerances of form, orientation, location and run-out*

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in EN 9300-007 and the following apply.

In addition EN 9300-100 offers further definitions of common terms as following.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
CAD 3D mechanical
3D Mechanic CAD covers the definition of the physical shape of a component, the positioning of components within an assembly, and the information about shape - such as tolerances or surface finish - which constrains the results of a manufacturing process, but does not specify the process itself. It may include a record of the geometrical operations, such as trimming a surface, which allow the shape to be subsequently edited, but excludes parametric design, in which shapes are generated using specific knowledge embedded in the CAD software

3.2
CAD 3D geometry
the representation of the geometric aspects of the part or assembly, using concepts such as point, line, cube, etc.

Note 1 to entry: For more information: see Annex B.

3.3
CAD 3D topology
although some classes of CAD modeller explicitly represent volumes (e.g. Constructive Solid Geometry), many represent volumes indirectly by representing only their surfaces or, in the case of wire frame modellers, only the edges. CAD 3D topology covers the system of relationships needed to interpret a collection of lower dimensional geometric elements as a 3D volume

Note 1 to entry: For more information: see Annex B.

3.4
"explicit" representation of a CAD model
in the context of engineering and 3D geometrical the term 'explicit representation' refers to the mathematical representation of the final result of the CAD model., From the designer's point of view, it corresponds to the 3D shape (points, curves, surfaces, solids), together with Geometric Dimensions and Tolerancing

Note 1 to entry: Explicit 3D shape may be associated with non-geometric data including design management meta-data such as layer, colour or group or user defined properties. These non-geometric data are optional, and are added by users and checked and validated by specific tools.

3.5
"implicit" representation of a CAD model
CAD model uses an implicit representation if its geometrical representation is based on a parameterization (e.g. 2D parametric sketches, 3D parametric features such as extrusions of 2D sketches, holes, pockets), together with a set of operations (e.g. extrusion, revolution) or constraints (e.g. perpendicularity, parallelism)

Note 1 to entry: The result of the processing of an implicit representation is a CAD 3D explicit representation, which can be used then for geometric operations such as measurement or clash detection.

3.6
3D Geometric Dimensioning & Tolerancing
symbolic language used on engineering drawings and computer generated three-dimensional solid models (CAD) for explicitly describing the nominal geometry and its allowable variation. This includes the nominal geometry of parts and assemblies, the allowable variation in form and possible size of individual features, and the allowable variation between features

Note 1 to entry: For archiving, GD&T information is a set of information types which are in direct relationship to each other. The set of information types includes:

— 3D geometry;

— 3D geometric dimensioning;

— 3D geometric tolerances.

Note 2 to entry: Dimensioning information is required to define the characteristics of the 3D explicit model, e.g. in terms of length or height. This additional information may be linked to one geometrical characteristic, e.g. the length of a line.

Note 3 to entry: No design geometrical feature can be manufactured to perfection, so the feature description can be extended with tolerance information. Tolerances may come in the form of limits of size applied to given dimensions, with ± style tolerance applied directly to dimensions or constraints, such as flatness or parallelism, or a general note.

3.7
Geometrical Product Specifications
GPS
equivalent to GD&T and PMI (Product Manufacturing Information)

3.8
3D notes
represent additional information, usually a text field, which has no geometric constraint or relationship to the 3D explicit model, unlike the GD&T information; the positioning of 3D annotation in the 3D environment of the CAD System is therefore a matter of how best to present the information to the user

The following figure shows an example of 3D annotation:

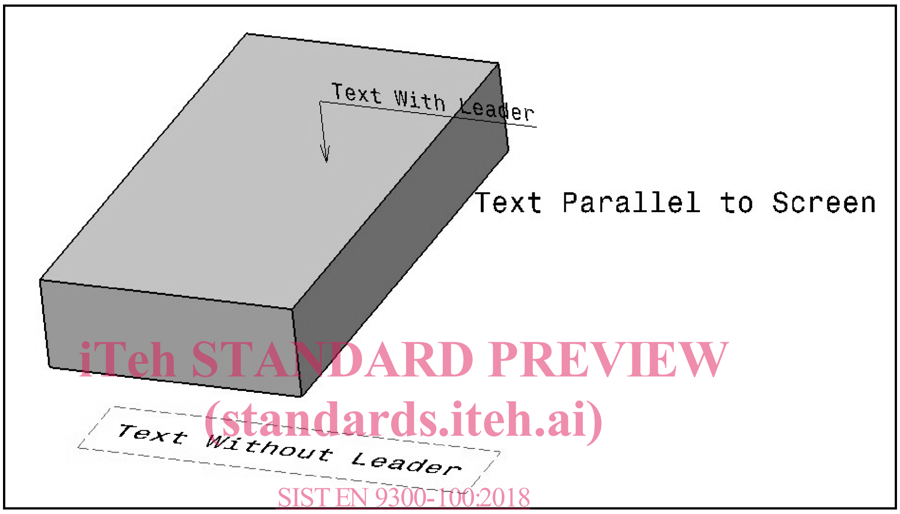


Figure 1 — 3D annotation

3.9
3D annotations
represent Dimension(s), tolerance(s), note(s), text or symbol(s) visible without any manual or external manipulation (see ISO 16792, 3.1)

3.10
types of information: "representation" versus "presentation"
3D representation of a CAD model is a mathematical formulation of a geometric shape; the presentation of that formula for a geometric display requires that the representation is rendered by the corresponding shape; the process of rendering requires additional presentation information, such as colour or transparency

Note 1 to entry: For example, a curve may be displayed as a set of pixels of a particular colour in a computer screen. For example, 3D Geometric Dimensioning and Tolerancing may be presented as a set of 3D polylines, however, if the GD&T information is represented only by polylines, the human may visualize and understand it as a GD&T, but the computer is not able to interpret it as GD&T, that is, it is not able to check its consistency with the 3G geometry.

Note 2 to entry: For a single concept, such as Geometric Dimensioning, there may be several representations of different levels of complexity, and enabling different capabilities. For example, a 3D Geometric Dimension can be represented as a set of specific objects with precise semantics, enabling automated update or consistency checking with the related 3D geometry shape subsets. (e.g., distance between two parallel faces).

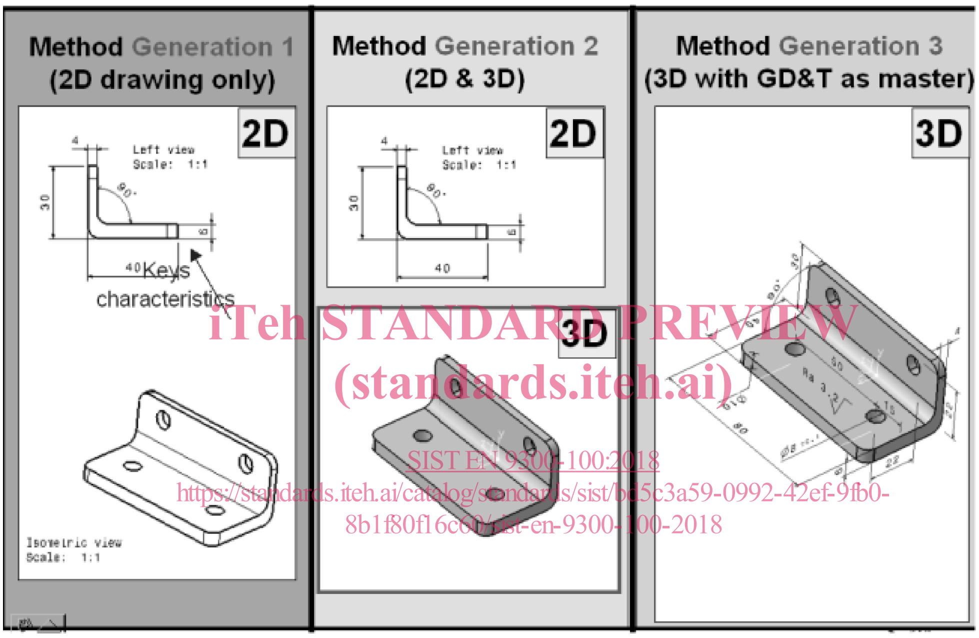
4 Applicability

Refer to applicability of EN 9300-001, clause 4.

5 Fundamentals and concepts for Long Term Archiving of CAD 3D mechanical information

5.1 Introduction

The family of EN 9300-1xx standards is based on the principles that, over the last 30 years, there have been major changes between the generations of CAD applications, resulting in change of the underlying representation of the CAD information, and there is a risk of further representational changes. Figure 2 illustrates this.



NOTE Figure 2 illustrates:

- The first generation of CAD design method was either to create a 2D drawing (without a 3D model), or to create CAD 3D model as support for the generation of a CAD 2D drawing. The essential information of the design intent is represented in a 2D drawing.
- The second generation of CAD design method is based on the complementary use of essential information defined in 3D models and essential information defined in 2D models (drawings).
- The third generation of CAD design method is based on the use of essential information defined only in 3D models that contain associative GD&T and annotation to effectively replace the need for a 2D representation.

For more details, see:

- Annex A: evolution of CAD Systems (historical view);
- Annex B: overview of the main types of CAD 3D mechanical information;
- Annex C: overview of the main CAD mechanical assembly structure information;
- Annex E: considerations for long term preservation of CAD 3D information.

Figure 2 — Illustration of the major generations of CAD systems

Some algorithms within CAD applications used in the aerospace industry are proprietary and are not available to the public. These algorithms represent a competitive advantage to the CAD Company. This results in the fact that aerospace manufacturers cannot guarantee the access to all essential design intent in its native format, over the life of the product.

The EN 9300-100 describes the methods for preserving CAD mechanical essential information over time, recognising that the mathematical representation may change between creation of the CAD information to its retrieval and hence after importation, the archived file has to be qualified as acceptable to a level of precision requested by the business function.

5.2 CAD essential information: dependencies on the CAD methods used

Manufacturers may use different CAD methods for the definition of 3D components. The definition of a part may be based on:

— 2D drawing only, fully dimensioned and toleranced, derived from a CAD 3D exact model;

— 2D drawing partially dimensioned and toleranced, derived from a CAD 3D exact model;

— 3D with GD&T, fully dimensioned and toleranced;

— 3D with GD&T, partially dimensioned and toleranced.

The next Figure sums up the type of CAD information to archive, showing:

— the type of CAD method used;

— the type of use cases for retrieval.

		Method 1	Method 2	Method 3
	Type of CAD information of the archive	2D drawing **fully** dimensionned and toleranced	2D drawing **partially** dimensionned and toleranced	
		3D model	3D model	
				3D model described by GD&T
	Need to measure dimensions on the 3D model	**NO**	**YES**	**YES**
Type of Use Case	Certification	Archive of 2D only	**Archive** of 2D AND **3D**	**Archive of 3D with GD&T**
	Product Liability	Archive of 2D only	**Archive** of 2D AND **3D**	**Archive of 3D with GD&T**
	Support in operation	Archive of 2D only	**Archive** of 2D AND **3D**	**Archive of 3D with GD&T**
	Reuse	**Archive of 3D and 3D with GD&T according to Company internal policy**		

Figure 3 — Type of CAD essential information to archive, depending on the CAD methods used

If a company uses method 1 for mechanical design, this company may decide to archive the CAD 3D model to ease the reuse, but it is not mandatory and depends of its internal policy. If a company uses method 2 for mechanical design, Long Term Archiving and Retrieval of 3D CAD models is required; if a company uses method 3, Long Term Archiving and Retrieval of 3D CAD with GD&T models is required.

5.3 Dependency of CAD essential information on use case

Following the regular enhancements of CAD applications, designers create new types of CAD information (see Annex A “Evolution of CAD systems”). This standard for Long Term Archiving and Retrieval of CAD information cannot be defined and implemented in the abstract, but it must be related to specific business requirements (see EN 9300-002 Clause 6 “Key requirements”) detailed by Use Cases (see EN 9300-003, Figure 8: Distinction of Business requirements, Business Cases and Use Cases).

These use cases describe precisely the functions to be supported by the preserved information after retrieval. Consequently they identify the essential information for archive specific to the use case, and the related mechanisms to validate the full process of preservation. This is illustrated by Figure 4 below.

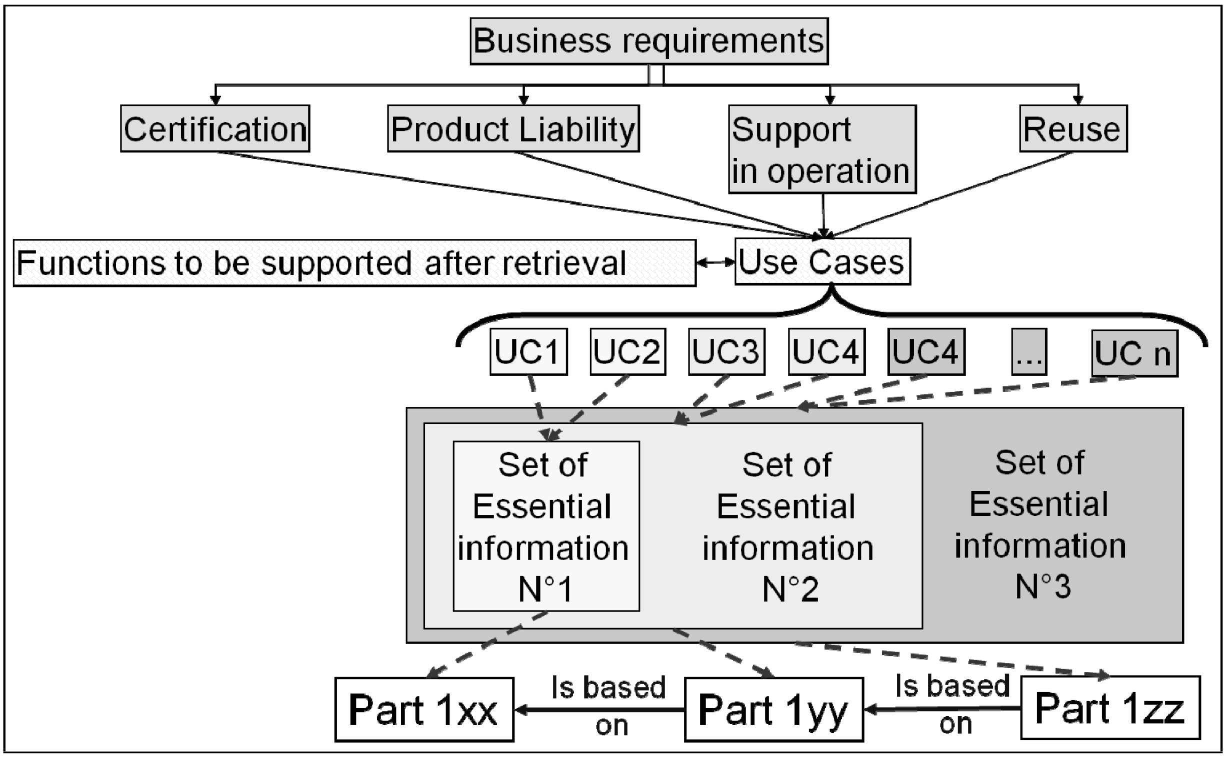


Figure 4 — Links between Use Cases, essential information and EN 9300 1xx parts

In this example, the part 1XX describes specifications for long term archiving of a set of essential information N°1, allowing to support retrieval for use cases 1 and 2. Then, the part 1YY describes specifications for long term archiving of a set of essential information N°2, including the set of essential information N°1, then supporting additional use cases 3 and 4. The Figure points out also that both the functions to be supported after retrieval and the associated levels of quality depend of the policy of risk management of the aerospace manufacturer (see 5.5).

5.4 Use cases shared by different aerospace communities

Aerospace manufacturers share some common requirements, such as certification and product liability, these result in common use cases for retrieval. However, there are also strong differences in products and processes between aerospace manufacturers, depending on:

— the type of product (satellites, large civil airframe manufacturer, engines etc.);

— the type of customers (civil, defence);

— the related processes of support.

As a result, the aerospace community does not share a single set of use cases. Some use cases are common only to a particular community of aerospace manufacturers, which may share the same legal constraints or business needs. Use cases specific to a company are not described; these may be related to a particular process, or part of a competitive advantage. Figure 5 illustrates the families of use case.