SLOVENSKI STANDARD
oSIST prEN 9300-121:2022

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Aeronavtika - LOTAR - Dolgotrajno arhiviranje in iskanje digitalne tehnične dokumentacije o izdelkih, kot so podatki o 3D, CAD in PDM - 121. del: Semantična predstavitev CAD 3D eksplicitnih informacij o geometriji z grafičnim izdelkom in izdelavo

Aerospace series - LOTAR - LOng Term Archiving and Retrieval of digital technical product documentation such as 3D CAD and PDM data - Part 121: Semantic representation of CAD 3D Explicit Geometry with Product and Manufacturing Information

Luft- und Raumfahrt - LOTAR - Langzeit-Archivierung und -Bereitstellung digitaler technischer Produktdokumentationen, wie zum Beispiel von 3D-, CAD- und PDM-Daten - Teil 121: Semantische Darstellung von eindeutiger 3D-CAD-Geometrie mit Produkt- und Fertigungsinformationen

Série aérospatiale - LOTAR - Archivage long terme et récupération des données techniques produits numériques, telles que CAO 3D et PDM - Partie 121 : Représentation sémantique de la géométrie CAO 3D explicite avec données de produit et de fabrication

Ta slovenski standard je istoveten z: **prEN 9300-121**

ICS:

01.110	Tehnična dokumentacija za izdelke	Technical product documentation
35.240.30	Uporabniške rešitve IT v informatiki, dokumentiranju in založništvu	IT applications in information, documentation and publishing
49.020	Letala in vesoljska vozila na splošno	Aircraft and space vehicles in general

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Aerospace series - LOTAR - LOng Term Archiving and Retrieval of digital technical product documentation such as 3D CAD and PDM data - Part 121: Semantic representation of CAD 3D Explicit Geometry with Product and Manufacturing Information

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee ASD-STAN.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (FprEN 9300-121:2022) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

This document is currently submitted to the Enquiry.

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-STAN, prior to its presentation to CEN.

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 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 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 EN9300 Geometric Dimensioning and Tolerancing will be referenced in ISO 1101 and ISO 16792, and for NAS 9300 the same information will be referenced in ASME Y14.5 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 document defines the requirements for the long term digital preservation of the Semantic Representation of Product and Manufacturing Information (PMI) with their possible links to the 3D explicit shape and geometry of single CAD parts. The goal is to preserve this 3D information, without loss, with respect to the geometry produced by the original CAD system, following the principles laid down in EN 9300-003 "Fundamentals and Concepts".

The requirements of EN 9300-110 concerning the preservation of the 3D explicit shape shall apply within this Part.

The term "semantic representation" is defined in Clause 3 "Terms, definitions and abbreviations".

1.2 In scope

The following outlines the total scope of EN 9300-121:

— machine-interpretable PMI "Semantic Representation" (Refer to Clause 3 for definition);

— the association of the above with 3D geometric shapes;

— the possible association of the above with Presentation of 3D Product and Manufacturing Information (PMI), and 3D annotations as defined in EN 9300-120.

In EN 9300-121, the technology used to preserve this 3D information is based on semantic representation. The main use cases are Certification, Product Liability and Design re-use.

For the purpose of this document, the semantic definition is at the level that supports associative "Cross-highlighting" for the purpose of human readability.

1.3 Out of scope

The following is outside the scope:

— PMI presentation (defined in EN 9300-120);

— User defined attributes that are assigned to 3D geometric entities or at the part level. The archiving of the UDA is defined in EN 9300-120.

— How to preserve additional information:

  — property rights;

  — form features;

  — CAD Assemblies.

  — The semantics of special Notes outside the scope of PMI: ITAR/EAR, proprietary, and title block information, etc.

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*

ASME Y14.5, *Dimensioning and Tolerancing*

ASME Y14.41:2012, *Digital Product Definition Data Practices*

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in EN 9300-007, EN 9300-100 and the following apply.

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

The following diagram illustrates the terms introduced in this Part:

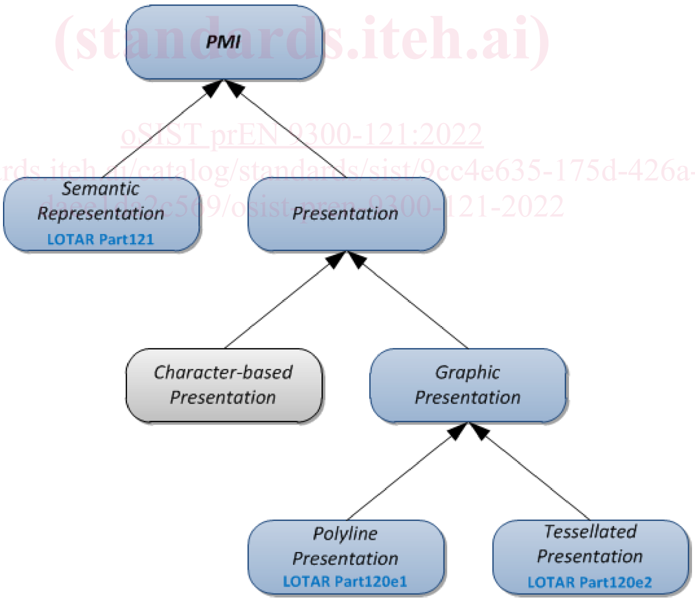

Figure 1 — Hierarchy of PMI Terms

3.1

Product and Manufacturing Information (PMI)

Product and Manufacturing Information (PMI) is used in 3D Computer-aided Design (CAD) systems to convey information about the definition of a product's components for manufacturing, inspections and sustainment, which supplements the geometric shape of the product. This includes – but is not limited to – data such as dimensions, tolerances, surface finish, weld symbols, material specifications, 3D annotations and user defined attributes. The term PMI, used by itself, relates to a certain information content within a product definition; i. e. it indicates what information is being stored, independent from how it is being stored

Note 1 to entry: Though PMI is generally accepted to be the generic designation, the term Geometric Dimensions and Tolerances (GD&T; sometimes also listed as Geometric Dimensioning and Tolerancing) is often used synonymously, as it is the main type of PMI that is currently in focus. Other synonymously used terms are: General Tolerances and Annotations, Annotation, Smart Dimensions, Functional Tolerancing and Annotation (FT&A) or Geometric Product Specification (GPS). Some of these are specific to a particular CAD system. Industry standards for defining PMI include standards such as ASME Y14.5, ASME Y14.41 and ISO 1101, ISO 16792 respectively.

3.2

Geometric Dimensions & Tolerances (GD&T)

Geometric Dimensions & Tolerances (GD&T) are a type of Product and Manufacturing Information (PMI) that can be either computed automatically by a CAD system, or entered manually by the user

Note 1 to entry: The definitions below are additions to the terms mentioned in 3.6 of EN/NAS 9300-100:

— *Explicit Tolerance:* Any tolerance with a stated (numeric) value, regardless of how or where it is applied. Explicit tolerances can be applied through general notes, flag notes, PMI or tolerance dimensions. This shall be attributable to a specific feature, feature set and/or datum reference (e.g. position, orientation). Standard ± 03 notes may be explicit, depending on their use.

— *Implicit Tolerance:* Any tolerance where there is no stated value and acceptability of the feature is defined by engineering to be through visual comparison to the appearance shown in the CAD model. Standard ± 03 notes may also be implicit, depending on their use.

— *Explicit Dimension:* The required nominal value is stated in the CAD model so that it can be obtained without interrogation.

— *Implicit Dimension:* The nominal value can only be obtained by interrogation (i.e. feature to feature measuring) of the CAD model.

3.3

semantic representation

semantic representation designates a certain way how information is being stored; it does not relate to the information content itself. Semantic Representation captures the meaning (intent) and relationships (context) of a character, word, phrase, sentence, paragraph, specification, or symbol without using any of the visual characters or constructs that are needed for a human to understand it – such as the letters, graphical symbols, lines and arrows used on engineering drawings

Note 1 to entry: The main purpose of Semantic Representation is to facilitate automated consumption of the data, e.g. for later re-use or for downstream applications. It applies to various types of data, such as PMI, Composite Material Definition, and others.

EXAMPLE The Semantic Representation of a Linear Dimension includes all of the information needed to understand the specification (the type of dimension, between which features it is defined…), without any of the graphic components such as dimension lines and extension lines, their direction, arrowheads and the dimension value.

3.4
presentation
presentation designates a certain way how information is being stored; it does not relate to the information content itself. Presentation defines the visual representation of a character, word, phrase, sentence, paragraph, specification, or symbol in way that is understandable by humans. Presentation is a generic term that applies to any form of human-readable information transfer; this can for instance be a handwritten note, an engineering drawing, or the display of a 3D CAD model on a computer screen

Note 1 to entry: The main purpose of Presentation is to facilitate human comprehension of the data, e.g. to manufacture, inspect, assemble or maintain the product described by the data. For a correct interpretation of the presented data, it is required that the reader is familiar with the alphabet used and the general type of information being presented.

Note 2 to entry: In the context of 3D CAD, the term Presentation relates to elements that are visible in the display of a 3D model and are either located (positioned) in 3D space, i.e. they rotate and move with the model, or in a fixed 2D plane. Elements of Presentation can typically by styled (e.g. coloured), organized (e.g. in specific views), and associated with other elements of the model. Presented types of data typically are geometry (3D shapes, surfaces, curves, points) and characters (letters, numbers, symbols).

3.4.1
character-based presentation
character-based presentation is a type of Presentation where the conveyed information is stored as characters (letters, numbers, and symbols). These characters are typically stored in a string variable that can be retrieved and edited in a consuming application. The appearance of Character-based Presentation depends on the font being used and may change if the originating system and the consuming application use different fonts. To ensure no characters are lost from creation to consumption, the alphabet (character encoding) used must be defined as well. (This supports both semantic and non-sematic PMI)

EXAMPLE In ASCII, the letter ‘A’ is stored as character code ‘0x41’ (hexadecimal).

Note 1 to entry: Character-based Presentation is often supplemented by geometric elements, such as leader lines, curves or terminator symbols.

3.4.2
graphic presentation
graphic presentation is a type of Presentation where the conveyed information is converted to geometric elements (lines, arcs, surfaces) by the source system in a way that preserves the exact appearance (colour, shape, positioning) of the presented information. The arrangement of these geometric elements can be interpreted by a competent human by looking at them, while the information content is no longer directly computer-accessible

EXAMPLE A simple graphic presentation of the letter ‘A’ is given by three straight lines. A more complex graphic presentation could have ten straight lines and six circular arcs, but would still be recognizable as an ‘A’ to a human familiar with the Latin alphabet. In both cases, a computer can only access the geometric definition of the individual elements (start and end coordinates for each line), but not the fact that it is the letter ‘A’ that is being presented.

Note 1 to entry: Graphic Presentation does not require defining the font or alphabet (character encoding) originally used in the creation of the presented data. In the way Graphic Presentation data are stored, there is typically no distinction between geometric elements that are visual representations of characters, and geometric elements that are visual representations of other constructs, such as leader lines, curves or terminator symbols.

Note 2 to entry: An indirect way of accessing the information content stored as Graphic Presentation is the application of character recognition software that will attempt to identify the original characters from the geometric elements that make up their visual representation. Character recognition, however, has its limitations depending on the algorithms used, the fonts and alphabet involved, and the granularity of the Graphic Presentation geometry elements. Its results cannot be used with the same level of reliability as Character-based Presentation.

3.4.3
polyline presentation
polyline presentation designates a specific implementation form of Graphic Presentation that is supported by many STEP Application Protocols, including AP203e2 (ISO 10303-203:2011), AP214e3 (ISO 10303-214:2010) and AP242 (ISO 10303-242:2014). It supports all the characteristics of Graphic Presentation. A Polyline is defined as an ordered list of 3D points, which are consecutively connected by straight line segments. Circles and circular are the only other allowed geometric elements, and can be used in combination with Polylines. Filled areas can be defined with the aforementioned elements as boundaries

3.4.4
tessellated presentation
tessellated presentation designates a specific implementation form of Graphic Presentation that is has been introduced during the development of STEP AP242 (ISO 10303-242:2014). It supports all the characteristics of Graphic Presentation. It is based on data model for tessellated geometry and provides more efficient ways of storing the data, compared to Polyline Presentation. It supports curves (composed of straight line segments) and surfaces (composed of triangles)

Note 1 to entry: This document defines long term archival and retrieval of 3D PMI using semantic representation.

4 Applicability

Refer to applicability of prEN 9300-001:2022 "Structure", Clause 4.

5 Business specifications for the long term archiving and retrieval of CAD PMI

5.1 Introduction

General specifications for long term archiving of CAD mechanical design information are described in EN 9300-100:2018 clause “Fundamental and concepts for Long Term Archiving of CAD 3D mechanical information”. This Part can be applied to PMI entities across other domains (i.e. electrical)

According to EN 9300-100:2018, 5.1 “Different generations of CAD systems and associated methods of design”, there are several methods of design:

— The first generation of CAD design method allowed the engineer to digitally create a 2D drawing (without a 3D model). The essential information as well as the Regulatory authority of the design intent is represented by the 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 parametric and relational design. The essential information as well as the Regulatory authority of the design intent is represented by the 3D model with PMI.