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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

DRAFT INTERNATIONAL STANDARD

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ISO/TC 184/SC 4

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Visualization elements of PLM-MES interface —

Part 2: 3D error feedback in heavy industry

ICS: 25.040.40

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee *ISO/TC 184, Automation systems and integration*, Subcommittee *SC 4, Industrial data*.

A list of all parts in the ISO 3151 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 General

Although there is a commercial product for the PLM-MES interface,^[1] there is no official standard for the PLM-MES interface. Although there are separate international standards for PLM or MES respectively, there is no international standard for interfaces for exchanging 3D product information and manufacturing information between PLM and MES. This standard part proposes a part of the PLM-MES interface as a standard for the engineering plant industry.

In order to establish the PLM-MES interface standard, data models of the existing PLM standards and MES standards can be used as a starting point of the interface. Since the entire scope of the PLM-MES interface is diverse and complex, the scope of this standard is focused on 3D visualization elements that feedback 3D error data found in the production department in the heavy industry to the design department.

When the interface is visualized, details of the entire interface are hidden, and a picture showing the overall view can be intuitively displayed. The schemas of the existing PLM standards and the schemas of the existing MES standards can be used to standardize the text format feedback sent from the production department to the design department. However, since the main obstacle is 3D shape data, it is difficult to use the existing schema as it is. The 3D visualization elements for feedback can be the first priority to start the development of the PLM-MES interface standard.

Figure 1 shows the contents defined by ISO DTR 3151-1, which outlines the visualization elements of the PLM-MES interface, and ISO PWI 3151-2, which is this part of the PLM-MES interface. The left side of Figure 1 shows the scope of ISO DTR 3151-1, which is mainly an overview, and the right side shows the scope of ISO 3151-2, which specifies 3D visualization elements for error feedback in the heavy industry.

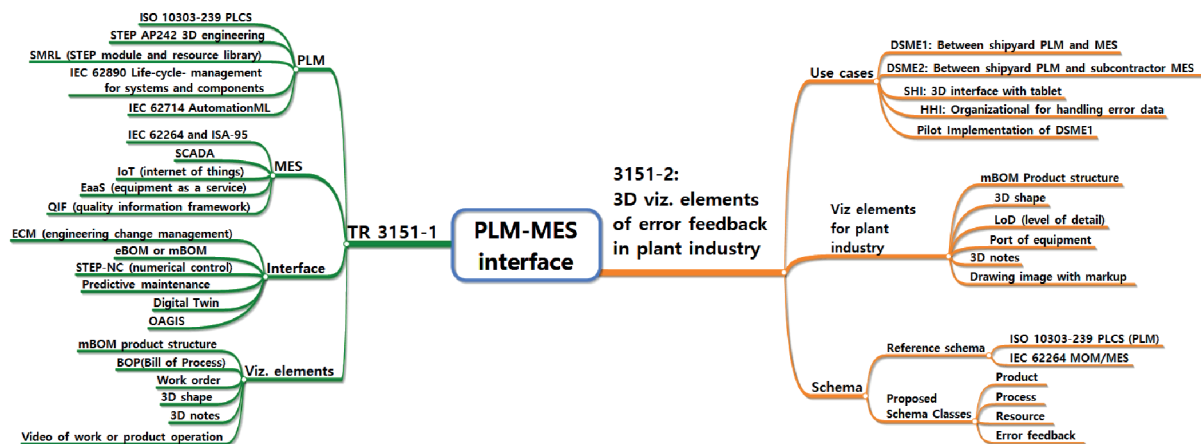


Figure 1 — Technology tree of PLM-MES interface

0.2 Simple and short-lifespan products vs. complex and long-lifespan engineering plants

Industry-specific product groups can be classified based on the length of the economic life. For example, there is a clear difference between the economic life of a nuclear power plant; the economic life of an aircraft; the economic life of a ship; the economic life of an automobile; the economic life of a TV; the economic life of a smartphone; and the economic life of mechanical parts or electronic parts.

An engineering plant, such as a power plant, is made of one million parts and has a service life of several decades. Since it is made-to-order (or custom-made), the demand for a 3D interface between PLM and MES is generally high.

On the other hand, small products such as motors, electronic components or control components used for communication or control are relatively simple and short-lived products. These small products

must be mass-produced to ensure economy, and have a short economic life due to rapid technological advancement. Therefore, the demand for 3D interfaces between PLM and MES is not high. However, manufacturing plants that produce small products are in the opposite position.

Visualization elements of PLM-MES interface —

Part 2: 3D error feedback in heavy industry

1 Scope

This part of the standard specifies a data model of visualization elements for 3D data exchange for error information feedback between Product Lifecycle Management (PLM) and Manufacturing Execution System (MES or MOM: Manufacturing Operations Management) in the engineering plant industry.

The followings are within the scope of this standard.

- a) Data model of visualization elements for the engineering plant industry with complex and long-lifespan products.
- b) Defining the properties of the data model for the visualization elements of the PLM-MES interface.
- c) Relationship with the information model of visualization elements as defined in ISO 10303-239 Product Lifecycle Support
- d) Relationship with the information model of the visualization elements as defined in IEC 62264 Enterprise Control System Integration
- e) The information flow with equipment used in production and related measuring equipment as managed inside MES

The following are out of the scope of this standard.

- a) Information model of visualization elements for the industry of products with simple and short-lifespan products.
- b) The definition of the method or application of the data model representing the visualization elements of the PLM-MES interface.
- c) Overall coverage of the PLM-MES interface. A bigger outline is covered in ISO DTR 3151-1.

2 Normative references

The following referenced standards are essential for the application of this standard. For dated references, only the cited version applies. For undated references, the latest edition (including amendments) of the referenced document applies.

ISO 10303-11:2004, *Industrial automation systems and integration — Product data representation and exchange — Part 11: Description methods: The EXPRESS language reference manual*

ISO 10303-46:2018, *Industrial automation systems and integration — Product data representation and exchange — Part 46: Integrated generic resource: Visual presentation*

ISO 10303-239:2012, *Industrial automation systems and integration — Product data representation and exchange — Part 239: Application protocol: Product life cycle support*

ISO/TS 10303-1132:2014, *Industrial automation systems and integration — Product data representation and exchange — Part 1132: Application module: Associative text*

ISO 14306:2017, *Industrial automation systems and integration — JT file format specification for 3D visualization*

ISO/IEC 19775-1:2013, *Edition 3.0 (2013-11-19) Information technology — Computer graphics, image processing and environmental data representation — Extensible 3D (X3D) — Part 1: Architecture and base components*

IEC 62264-2:2015, *Enterprise-control system integration — Part 2: Objects and attributes for enterprise-control system integration*

IEC 62264-4:2016, *Enterprise-control system integration — Part 4: Object model attributes for manufacturing operations management integration*

ISO/TR PWI 3151-1 Visualization elements of PLM-MES interface

3 Terms, definitions and abbreviations

For the purposes of this document, the terms and definitions given in ISO/IEC 20924 apply.

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

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

3.1 Terms and definitions

3.1.1

port information (of a plant equipment):

Portion of an equipment or pipe fittings which is used to connect the equipment with other part of the plant, usually piping

3.1.2

3D note:

Text information attached to graphical information of a digital shape model of a product

3.1.3

X3DOM (pronounced "X-Freedom"):

An open source JavaScript framework, used to create declarative 3D scenes in web pages.

3.1.4

level of detail (LoD)

decrease in complexity of a 3D model representation as it moves away from the viewer or according to other metrics such as object importance, viewpoint-relative speed or position

3.2 Abbreviations

3D	Three Dimensional
AP	Application Protocol
BOM	Bill Of Material
DSME	Daewoo Shipbuilding and Marine Engineering
eBOM	Engineering BOM
ERP	Enterprise Resource Planning

HHI	Hyundai Heavy Industries
ID	IDentifier
IEC	International Electrotechnical Commission
ISA	International Society of Automation
ISO	International Organization for Standardization
mBOM	Manufacturing BOM
MES	Manufacturing Execution System
MOM	Manufacturing Operations Management
PDA	Personal Digital Assistant
PLCS	Product Life Cycle Support
PLM	Product Lifecycle Management
SHI	Samsung Heavy Industries
STEP	STandard for the Exchange of Product model data
xBOM	Any BOM including eBOM, mBOM

4 PLM-MES interface

4.1 Needs for a PLM-MES interface in the heavy industry

In the heavy industry or the construction industry, made-to-order production (personalized production) has been carried out from the early days of the industry, hundreds of years ago. Because every product has an individual design, and there is pressure to design the product quickly, the production cycle begins even though the design is not yet complete. However, because of the design cost, it cannot afford multiple iterative design cycles.

In this context of overlapping design and production (the concept is already widely used in concurrent engineering), the design department and the production department need to work closely together and exchange data. Because both the design department and the production department operate in a 3D world, 3D data need to be shared between the two departments.

Even in the mass production industry such as the automotive industry, the need for a PLM-MES interface is growing as the smart manufacturing is spreading. The automotive industry is gradually moving from the mass production toward the mass customization and finally to the personalized production (lot size 1) similar to the heavy industry or the construction industry. As the mass production industry moves toward the personalized production, the needs for a PLM-MES interface between the production department and the design department is increasing.

Similarly, the PLM-MES interface is also needed to compensate for the deviation between R&D (prototype production) facilities and mass production (volume production) facilities in the mass production industry. In order to minimize deviations or errors between R&D facilities and mass production facilities, a PLM-MES interface including a 3D interface is needed. As personalized production progresses, it is expected that R&D (prototype production) facilities and mass production (volume production) facilities will become similar.

Since the heavy industry has been producing to made-to-order from the beginning of the industry, there are many use cases and know-how for personalized production. On the other hand, it is difficult

to find good use cases for personalized production in mass production-type manufacturing industries such as the automotive industry or the electronics industry, yet.

4.2 Two Related Standards

ISO 10303-239 Product Lifecycle Support (PLCS) is a standard for PLM that defines an information model for product design, production processes and resources during the entire product lifecycle of a product, as shown in [Figure 2](#).

AP239 is an application protocol (AP) that manages the lifecycle of a product, so [Figure 2](#) shows the relationship with other APs of ISO 10303 related along the time axis of product development. The core of AP239 is to manage product overview data for the whole period of time, while other APs are in charge of more detailed areas in a certain part of the time axis.

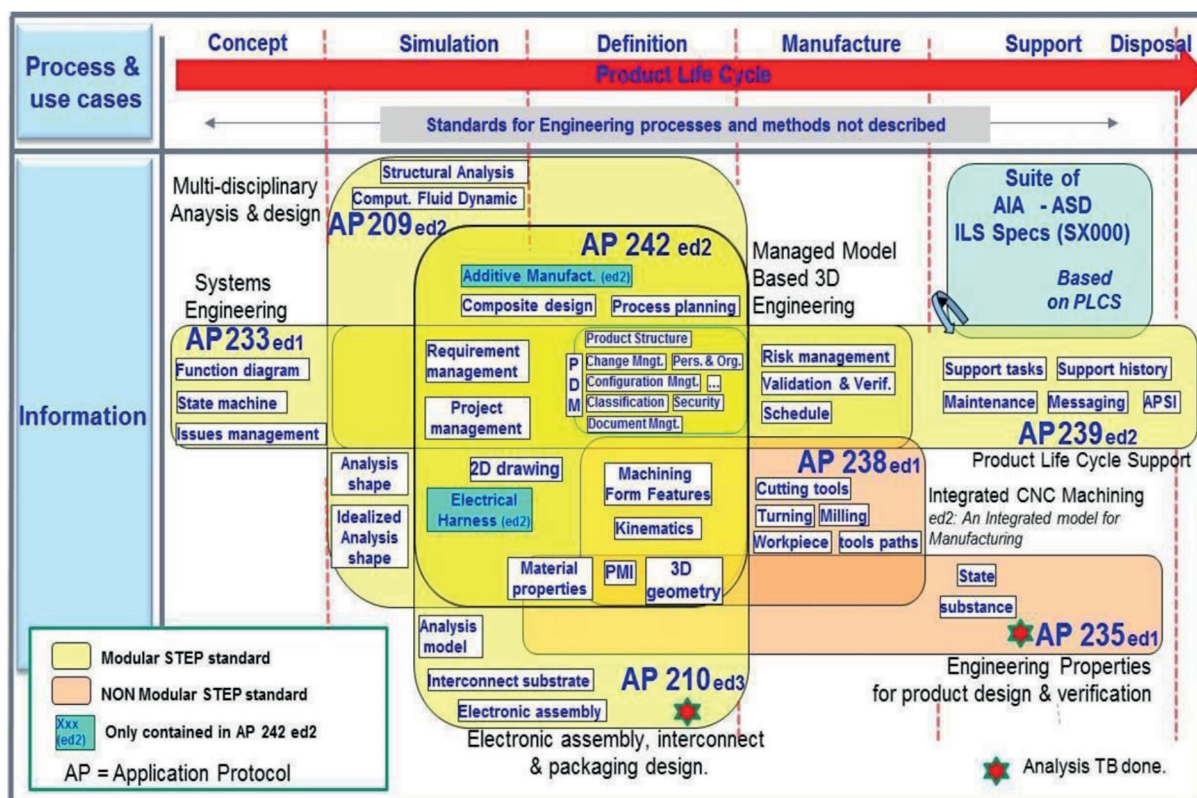


Figure 2 — Scope of ISO 10303-239 and related standards for PLM^[2]

The IEC 62264 standard is being developed based on ANSI/ISA-95.^[3,4] The IEC 62264 series is developed in JWG 5 which is jointly established by ISO/TC/184/SC5 and IEC/TC65/SC65E, and consists of the following standard parts.

Part 1:2013 Object Models and Attributes of Manufacturing Operations (First edition 2003-03)

Part 2:2013 Object model attributes (First edition 2004-07)

Part 3:2016 Activity models of manufacturing operations management (First edition 2007-06)

Part 4:2015 Objects models attributes for manufacturing operations management integration

Part 5:2016 Business to manufacturing transactions

PAS Part 6:2016 Messaging Service Model