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Industrial automation systems and integration — Standardized procedure for production systems engineering —

Part 2:
Reference process for seamless production planning

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Foreword

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The committee responsible for this document is ISO/TC 184, *Automation Systems and Integration,* Subcommittee SC 4, *Industrial data.*

ISO 18828 consists of the following parts, under the general title *Standardized procedures for production systems engineering*

— Part 2: Reference process for seamless production planning

The following parts are under preparation:

— Part 1: Overview, concepts and integration

— Part 3: Information management of seamless production planning – Information flow within production systems engineering

— Part 4: Measurability of production planning processes – Key performance indicators for production systems engineering

— Part 5: Manufacturing change management

Introduction

This part of ISO 18828 describes a reference planning process which aims to establish a consistent understanding of production planning processes in the lifecycle stage of production preparation addressing the phase in between design and manufacturing (see **Figure 1**). The primary application domain of the reference planning process is process planning for serial production systems.

Investigations in the area of manufacturing lucidly show an increased utilization of digital planning tools to master product and process complexity and respond to continuous cost and time pressure. Production planning today uses many different IT-tools. These tools are mostly standalone solutions that are highly oriented towards specific use cases. However, the isolation of the IT-tools hinders sustainable system consistency. The heterogeneity and incompatibility of the IT systems hampers interdisciplinary planning across multiple phases. A lack of clear structures for each phase leads to inefficient planning and redundant processes, multiple work, transformation failures, incomplete information etc. In addition, the comparison of planning results as well as information transfer between different planning disciplines is difficult. Despite this abundance of IT tools as well as an overflow of various process descriptions on all kind of specialized production domains in literature, a lack of common standards is presently observable.

NOTE For further readings see **Bibliography**

The reference planning process introduced within this document is illustrated in **Figure 1**. It is embedded between the product design process and the production process. This illustration depicts the sequential phases of the product life cycle, beginning with the concept phase, followed by the evaluation of the product design until the start of manufacturing. It furthermore stresses the major importance of a reference process for production planning as a link between product design and production itself. A detailed visualization of the planning processes is given in **Annex B**.

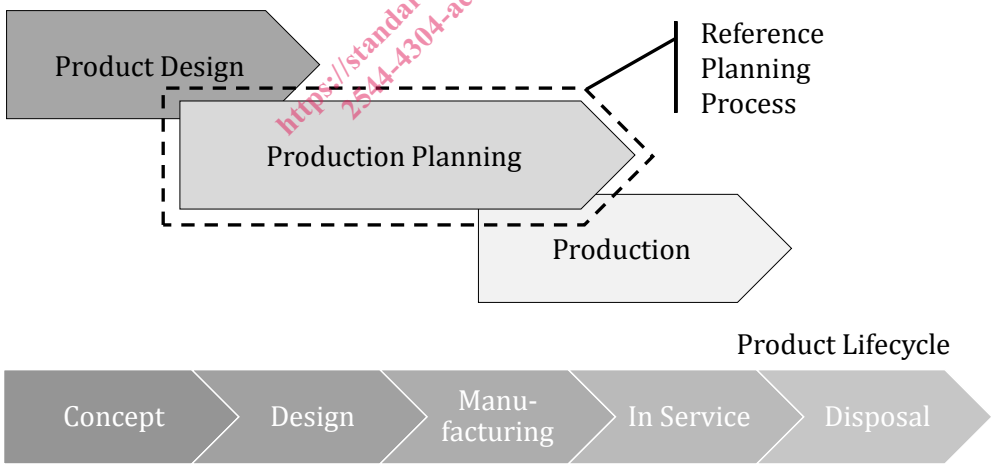

Figure 1 — Classification of the reference planning process (qualitative depiction)

To achieve the goal of a consistent planning and harmonization of the multiple processes, the development of a reference process for production planning is therefore envisioned. Planning processes within the manufacturing phase will be analyzed and merged to optimize the efficiency and transparency of each process activity. Thereby organizational, technological/technical and conceptual barriers are identified and with appropriate measures minimized or totally eliminated.

In order to integrate IT systems across the multiple phases of product development, it is therefore necessary to formalize and standardize the processes used in production planning.

Automation Systemes and Integration — Standardized procedures for production systems engineering —

Part 2:
Reference process for seamless production planning

1 Scope

This document describes a reference planning process for seamless production planning. The scope of the discussed reference process focusses on the production planning for products in serial production. The analysis of the process activities has been limited to those within the production planning. The following aspects are within the scope of this document:

— General overview of the reference planning process

— Basic principles of the process model

— Description of each level identified within the reference planning process for production planning

— Structure of activities and relations within each planning discipline

— Dependencies of interdisciplinary activities

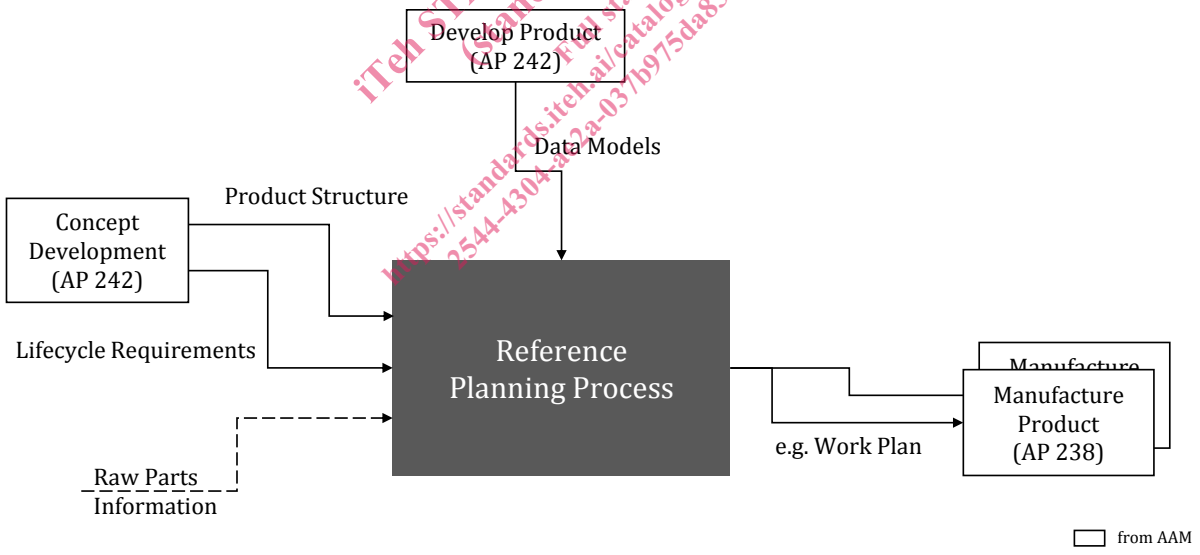

Figure 2 — Integration scenario of the reference planning process considering ISO 10303 AAM

NOTE For further demarcation and possible integration to other standards considering industrial data e.g. product data (ISO 10303), component data (ISO 13584), production data (ISO 15531) and life-cycle data (ISO 15926) see **Bibliography**

For user specific applicability the description of the model will be realized by the use of different levels of detail. The reference planning process, as shown in **Figure 1** comprises the totality of processes within the production planning. Additionally **Figure 2** depicts the reference planning process viewed as an embedded process taking input information from earlier phases of the product life cycle provided for instance in STEP AP 203/214/242 etc. and releasing information such as work schedules to follow-up

processes (such as described in STEP AP 238). A general overview and a detailed explanation of all processes within the reference planning process follow in Section 0.

The following items are out of scope:

— Material requirement planning / manufacturing resource planning

— Production order control

— Production process

— Early stage product design

— Order management, inventory management, purchasing, transportation, warehousing

— Production facilities planning/ manufacturing facilities planning (physical plant and equipment); that includes any kind of resource that is not directly related to the manufacturing process

— Value chain (inbound logistics, operations management, outbound logistics, marketing and sales)

— Resource visualization

— Process simulation

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.

ANSI/IEEE 1320.1 (2004-00-00), *Functional Modeling Language - Syntax and Semantics for IDEF0*

3 Terms and definitions

3.1 Terms defined in ISO 10303-1

This part of ISO 18828 makes use of the following terms defined in ISO 10303-1:

— product

3.2 Terms defined in ISO 15531-1

This part of ISO 18828 makes use of the following terms defined in ISO 15531-1:

— manufacturing

— manufacturing management

— manufacturing planning

— manufacturing process

— master production schedule

— master production scheduling

— process

— process planning

— production control

— production facilities; manufacturing facilities

— production order control

— resource

— resources requirements planning; rough cut capacity planning (RCCP)

— scheduling

3.3 Other terms and definitions

For the use of this document the following terms and definitions apply.

3.3.1
Container concept
The explicit choice of a transport container, such as blister packs, lattice boxes or small parts containers.

3.3.2
Delivery concept
Strategy adopted to supply individual parts, modules or finished products to the assembly and manufacturing resources.

3.3.3
Delivery concept
Strategy adopted to supply individual parts, modules or finished products to the assembly and manufacturing resources.

3.3.4
Feasibility
Technical feasibility

3.3.5
Production process management
The planning process during the production phase. After the start of production the production process management is involved if process or product changes (requests) occur which lead to a new planning iteration. It does not include the operation planning, planning of materials and resources or the planning and control of production.

3.3.6
Operating resources
Movable and immovable resources that contribute to production.

3.3.7
Planning of machines, facilities and equipment
Definition, quantity, specifications, and technical specifications of required machines, facilities, and operating resources, as well as planning the required capacity.

3.3.8
Planning scenario
Combination of certain planning variants from all planning disciplines

3.3.9
Process chain
Sequence of process activities

3.3.10
Product design process
The process of design a product from the idea for a product through to the last EBOM.

3.3.11
Product Structure (EBOM)
The product structure provides a functional classification of all items, parts, components, sub-assemblies and assemblies of a product. The hierarchical "as-designed" product structure which is defined during product design allows the creation of an engineering bill of materials (EBOM).

3.3.12
Reference planning process (for production planning)
Process from the initial product definition – usually from the end of the concept phase – to delivery of the last work plan in series planning. It does not include production control.

3.3.13
Work system
Used to fulfill a work task and is described by the seven system terms (work task, work progress, human, resource and equipment, input, output, environmental influences).

3.5 Abbreviations and descriptions

For the use of this document the following abbreviations and descriptions apply.

3.5.1
Assy
Assembly

3.5.2
BOM
Bill of materials

3.5.3
CAD
Computer-aided design

3.5.4
CNC
Computerized numerical control

3.5.5
EBOM
Engineering BOM (BOM from the design perspective)

3.5.6
est
estimated

3.5.7
Ext
Extended

3.5.8
MBOM
Manufacturing-BOM (BOM from the production perspective)

3.5.9
Mfg
Manufacturing

3.5.10
PLC
Product life cycle

3.5.11
SADT
Structured Analysis and Design Technique

3.5.12
SOP
Start of production

4 Reference model for production planning process

To provide information for different user groups and use cases, the reference process model for production planning is based on a multi-level structure. The process is detailed by progressive stages in a top down approach. The degree of abstraction decreases by drilling down the levels. The number of available levels depends on the processes and the connected sub processes. Here, the main processes are broken down into several sublevels. To reach an appropriate degree of abstraction, especially for the main planning functions, five levels are defined. These levels are illustrated in **Figure 3**. The notation of the elements within the process represents their respective model level in order to reach a better orientation while going through the description of each process. Except for the root process A0 at model level 0, each process refers to the model level according to the number of numeric digits in the notation (for instance: the process A2.2.1 contains three numeric digits and therefore belongs to the model level 3).

NOTE Syntax and Semantics are used according to the functional modeling language ANSI/IEEE 1320.1.

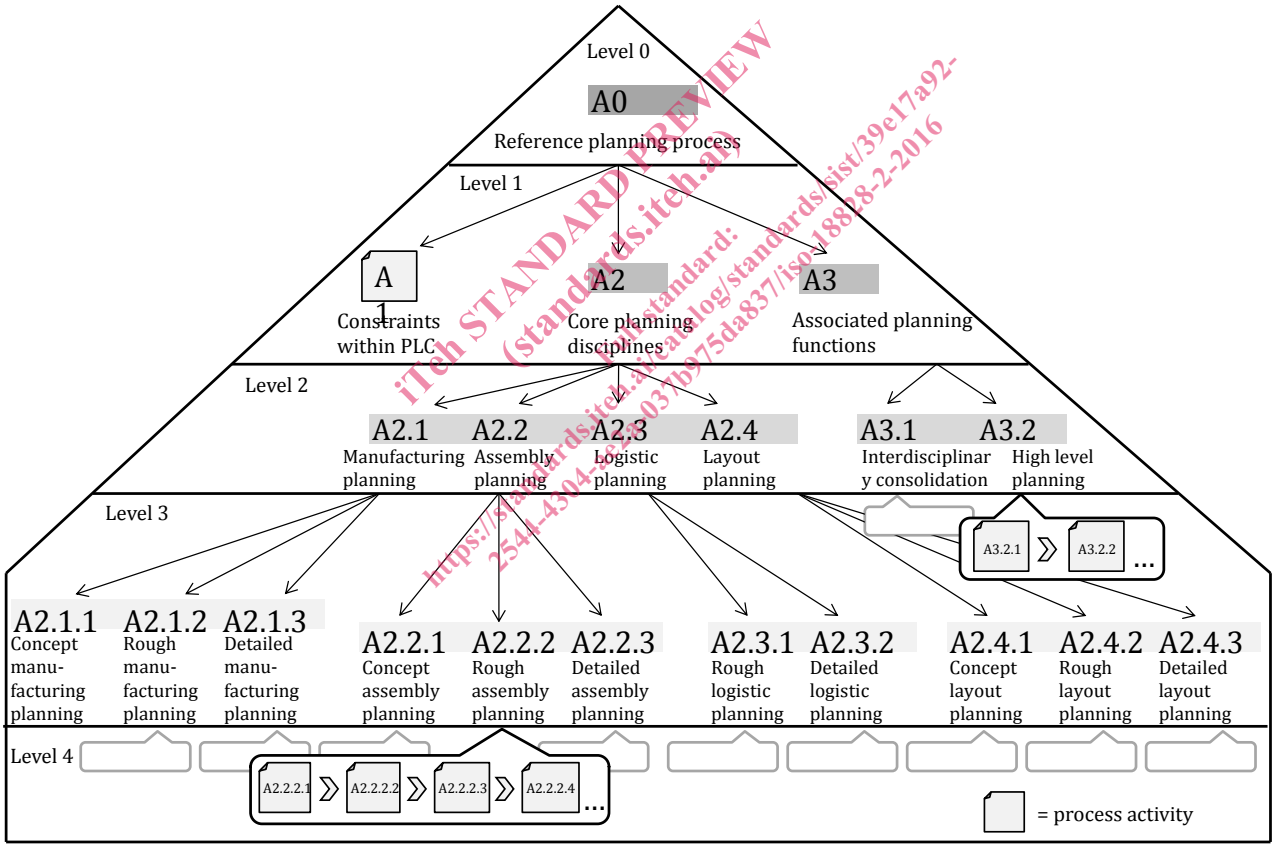

Figure 3 — Structure of the reference planning process model

The consideration and control of the complexity are essential for the development of the reference planning process. The modeling makes use of combining recurrent functions and constraints into aggregated modules. As a result, clear structured planning processes consisting of input and output data, control mechanism and methodic support have been modelled. Thereby both, functions at the interface of the reference planning process and consolidations within the planning disciplines are combined at the root level. This aggregation leads to a significant increase of clarity of description and enables a prioritized view for the user at the given core discipline. The description of the detailed model levels follows the same top down approach. First the level with the highest degree of abstraction will be described (referred to as level 0), following a description of the level consisting of the main function of

