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

Part 5: Manufacturing change management

Systèmes d'automatisation industrielle et intégration — Procédures normalisées pour l'ingénierie des systèmes de production —

Partie 5: Gestion du changement de fabrication

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Foreword

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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 18828 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

An increasingly dynamic business environment and the rapid changeover from a buyer's to a seller's market have gradually been increasing the complexity that companies are facing over the course of their product creation processes. Shortening product lifecycles, the extension of planning extents across global planning networks and an unwaveringly high expectation of process stability and quality have all turned change management within the product creation process into a vital success factor for internationally active manufacturers. In some of their departments, such as product development and the associated product data management, manufacturers have already begun responding to these developments by establishing sophisticated and technically supported processes that provide change-driven management within the product development process. However, this coordination and structural mapping of product changes [better known as engineering change management (ECM)] covers only a part of the relevant change processes occurring in digital product creation. Although ISO 10303, ISO 15531, ISO 19439 and IEC 62264 offer several data models, the current context of this document focuses on the area of production planning. Heterogeneous information technology (IT) systems and data models are common use due to the high amount of variations in the planning process. The data scheme in this document offers a generic method to structure the data and to present basic object types in order to implement manufacturing change management. In practice, the product systems required for the manufacturing and assembling of the products are likewise subject to many different changes. Some of these changes are preplanned and they are implemented specifically to achieve efficiency increases. Other changes, however, are subject to processes that are less structured or planned, which means that their practical repercussions and follow-up measures often cannot be adequately predicted. Typical for all of these types of change measures is the fact that the production system's applicable documentation and the actual state of production are temporarily or permanently inconsistent with each other, i.e. they are asynchronous (see Figure 1).

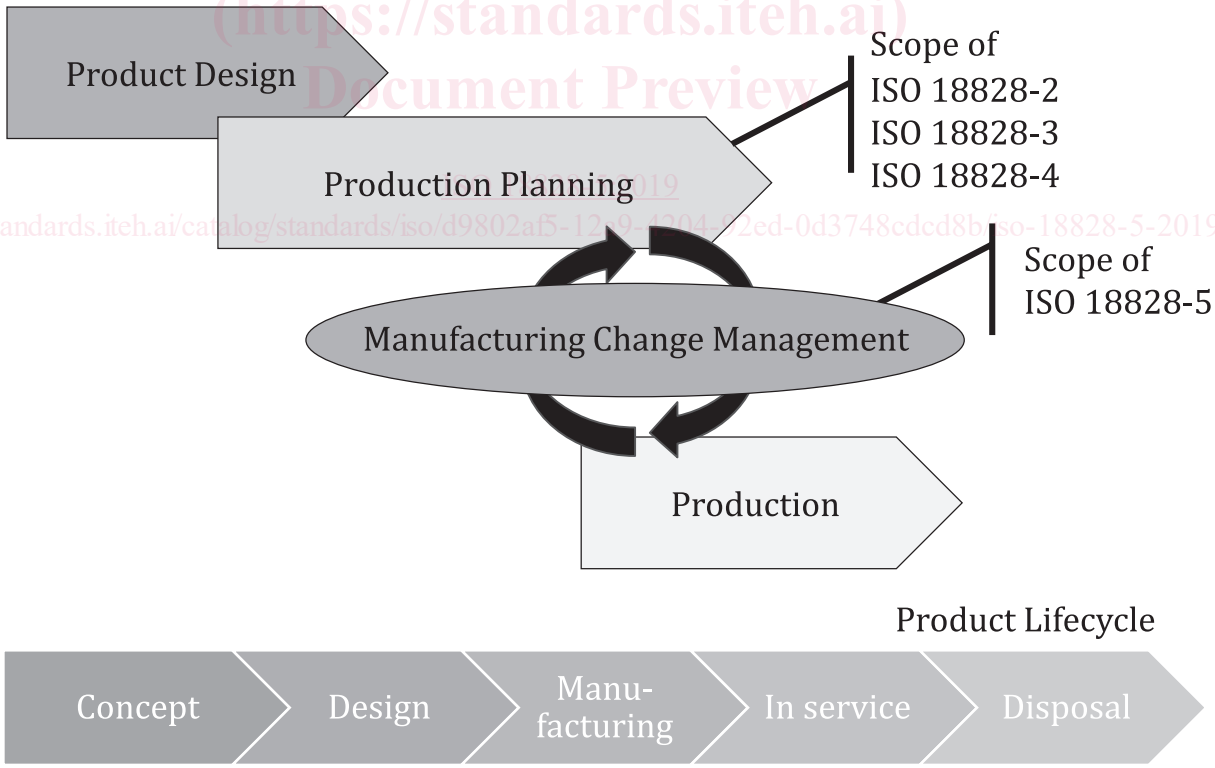

Figure 1 — Context of manufacturing change management

The applicable documentation for the creation, the commissioning and the operation of production systems is provided by the planning documentation. At the start of production, the documents and definitions of the planning departments serve as a reference for everything. Subsequently, some new measures typically emerge that are more practical than the originally planned ones, and they are the

ones that are ultimately implemented. Figure A.1 provides an example of how a system's actual state can deviate from the planned state over time. There are many different ways in which deviations from the planned state can occur. For example, ongoing improvements to the process often reduce the base time required for completing the process, thereby directly increasing its efficiency. Of course, there can also be entirely different adjustments, e.g. pertaining to ergonomics or machining capacities. These cannot be visually mapped and evaluated as easily. In addition, the triggers for changes can vary considerably and they can be identified and suggested by a wide variety of parties. Starting when the initial production process is implemented, the many changes that are introduced subsequently represent the actual manufacturing process at any given time. In the context of holistic production systems, the adaptability of manufacturing processes is crucial to competitiveness. Across-the-board efficiency increases are usually demanded on a yearly basis, creating a strong need for streamlining. In order to permanently adapt and optimize the process, the planning documentation necessarily deviates from the actual state of the production system sooner or later, i.e. all producers experience their manufacturing processes deviating from the original planning to some degree. However, in order to test, evaluate and reach the goals set in terms of quality, time required and cost-effectiveness, the planning needs to be constantly compared to the actual state. Any changes to the manufacturing process and planning take place over the course of an iterative process requiring the agreement of numerous participants.

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

Part 5: Manufacturing change management

1 Scope

This document specifies a formal description of the manufacturing change management (MCM) processes to provide an organizational and technical solution for the comprehensive mapping and processing of changes between production planning and operations. The aim of this document is to uniformly capture and track change measures, and to sensibly forecast and coordinate the capacities required for change processes in the planning and production departments.

This document presents a data-oriented view for implementation of MCM. The most important aspect of the data-oriented view is that the central change element is linked to the objects of the digital factory (i.e. the process, the product and the resource). The basis for MCM and the different views presented in this document are production planning processes.

ISO/TR 18828-1 gives an overview of the ISO 18828 series and links the MCM to the other parts of ISO 18828, focussing on production planning processes, as well as information flows and key performance indicators. The following aspects are covered within this document:

— processes of MCM;

— roles in MCM;

— data-oriented view of MCM;

— workflow of MCM.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions 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 http://www.electropedia.org/

3.1
manufacturing change management
MCM
overall change management activities that apply for manufacturing

3.2
manufacturing change request
MCR
initial stage of the *manufacturing change management* (3.1) in which a request for a change is made and evaluated

3.3
manufacturing change order
MCO
final stage of the *manufacturing change management* (3.1) in which the implementation and accompanying steps of the requested manufacturing change are conducted

3.4
acquisition
steps from the change enquiry to the released change request

3.5
evaluation
clarification of and decision about a change request as well as the subsequent steps

3.6
receive change order
formal activity how a change order is obtained for further processing

3.7
plan change order
arrangement or updating of the product plan and the associated planning documentation

3.8
implement change order
realization of the manufacturing change in the production facility

3.9
inform participants
information of participants about the change to increase transparency

3.10
complete change order
update and documentation of the change status, as well as informing the initiators of the change request

3.11
create change enquiry
initial stage of the *acquisition* (3.4), where the change enquiry is initiated

3.12
process change enquiry
examination of the change enquiry

3.13
create change request
preparation of the change request

3.14
maintenance of manufacturing change list
updating and prioritizing the change requirements in the *manufacturing change list* (3.25)

3.15
compare affected objects
reconciliation of existing change requests and affected objects

3.16
clarify change request
examination of the change request

3.17
release change order
clearance of the change order

3.18
assign change order
identification of a suitable person and issuing responsibility

3.19
compare shopfloor and planning documentation
collation of workshop and planning document

3.20
production planning of change order
change order in regard of documentation required for the shopfloor

3.21
update change status
update of the change status in the documentation

3.22
inform change request initiator and creator
report of the conducted change to the request initiator and creator

3.23
manufacturing change management process
process consisting of two basic structural stages: the *manufacturing change request* (3.2) and the *manufacturing change order* (3.3)

3.24
manufacturing change management roles
relevant roles needed to ensure all functional and process-related operations for the *manufacturing change management process* (3.24)

3.25
manufacturing change list
MCL
relevant changes in the manufacturing environment (shop floor)

3.26
product structure
structure providing a functional classification of all items, parts, components, subassemblies and assemblies of a product

Note 1 to entry: The hierarchical "as-designed" product structure which is defined during product design allows the creation of an engineering bill of materials.

[SOURCE: ISO 18828-2: 2016, 3.1.9]

4 Abbreviated terms

ECM	engineering change management
CIP	continuous improvement process
IT	information technology

MCM manufacturing change management

MCO manufacturing change order

MCR manufacturing change request

MCL manufacturing change list

5 Process-oriented view of manufacturing change management

The process model of manufacturing change management is based on a multi-level structure. The model is detailed by progressive stages in a top down approach. The degree of abstraction decreases by drilling down through the levels. The number of available levels depends on the processes and the connected subprocesses. Here, the main processes are broken down into several sublevels. To reach an appropriate degree of abstraction, especially for the main change activities, four levels are defined. These levels are illustrated in Figure 2. 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 0 at model level 0, each process refers to the model level according to the number of numeric digits in the notation.

EXAMPLE 1 The process 112 contains three numeric digits and belongs to the model level 3.

The process number in each level includes the stage numbers of the upper-level-processes.

EXAMPLE 2 The process 112 (Process change enquiry) is derived from the processes 1 (Manufacturing change request) and 11 (Acquisition).

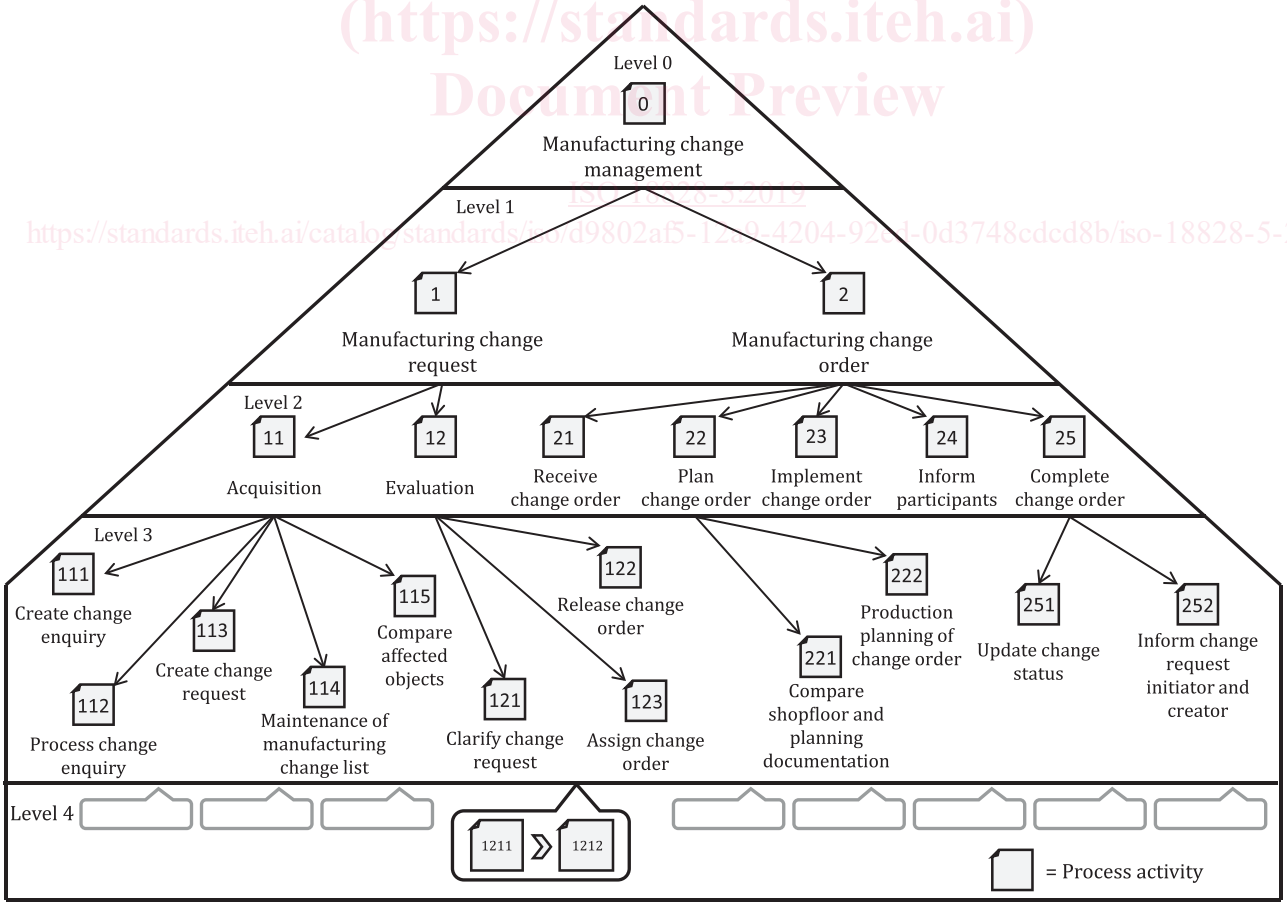

Figure 2 — Structure of manufacturing change management process model

The modelling makes use of combining recurrent functions and constraints into aggregated modules. As a result, clear structured processes consisting of input and output data have been modelled. The description of manufacturing change management is 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 change management process. The description of the detailed model levels follows the same top down approach. First, the level with the highest degree of abstraction is described (referred to as level 0), following a description of the level consisting of the main function of the manufacturing change management process. In reference to this basis, every possible characteristic change activity is consecutively described. To ensure a consistent description of the different model levels, the detailed description of the levels contains the following structure:

— the graphical abstract of the detailed process activities using Structured Analysis and Design Technique (SADT) notation;

— the textual description of the process activities;

— the additional explanation of specific model details.

6 Detailed description of process 0

As illustrated in Figure 3, the manufacturing change management consists of two basic structural stages:

— the manufacturing change request (MCR) (1);

— the manufacturing change order (MCO) (2).

These two stages are described in greater detail in the following clauses.

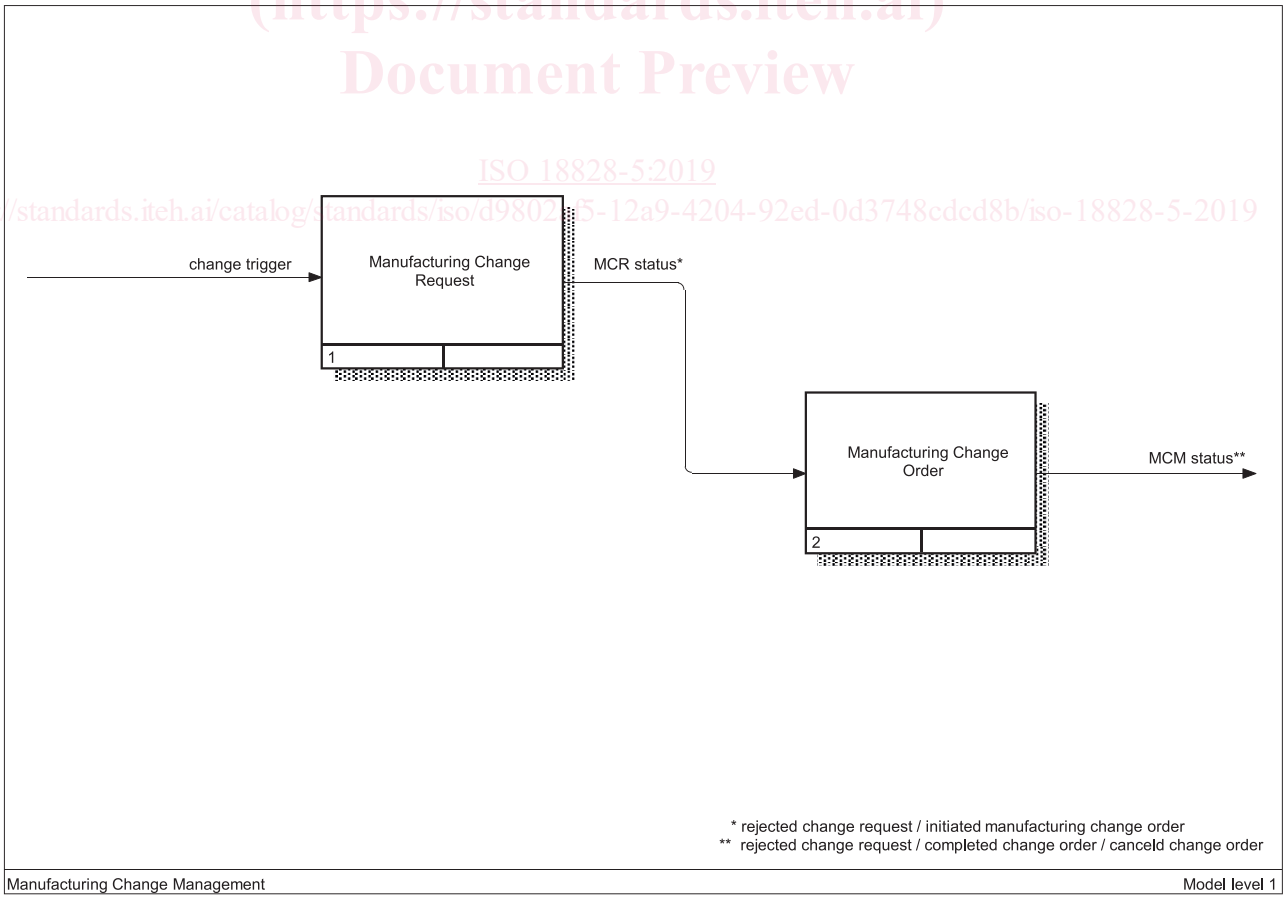

Figure 3 — Structure of "manufacturing change management" at model level 1