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Industrial automation systems and integration — Industrial manufacturing management data —

Part 43:
Manufacturing flow management data: Data model for flow monitoring and manufacturing data exchange

Systèmes d'automatisation industrielle et intégration — Données de gestion de fabrication industrielle —

Partie 43: Données de gestion des flux de fabrication: Modèle de données pour suivi des flux et échange des données de fabrication

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Contents

ISO 15531-43 : 2006 (E)

Figures

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ISO 15531-43:2006
https://standards.iteh.ai/catalog/standards/sist/87ab77f0-bb82-4fd1-a0dc-
48649fb4f7f7/iso-15531-43-2006

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15531-43 was prepared by Technical Committee ISO TC184/SC4, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data*.

A complete list of parts of ISO 15531 is available from the Internet:

http://www.tc184-sc4.org/titles

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Introduction

The information generated about the manufacturing process of an industrial product is very important for the life cycle of this product, notably in a context of sustainable development. Manufacturing may be defined as the transformation of raw material or semi-finished components leading to goods production. Manufacturing management is the function of directing or regulating the flows of goods through the entire production cycle from requisitioning of raw materials to the delivery of the finished product, including the impact on resources management.

A manufacturing management system manages the flow of information and materials through the whole production chain, from suppliers, through to manufacturers, assemblers, distributors, and sometimes customers.

The relations among those partners may be identified and structured in an electronic form with a view to facilitating electronic exchanges. Information handled during these exchanges is identified, modelled and represented in such a way that may be shared by a maximum of partners through the usage of standards for product and manufacturing data modelling.

The production planning functions within the supplier plants are assumed to have strong relationships with the master production scheduling functions of the main plant, which shares information with them, on the likely pattern of the future demands to allow suppliers to plan in turn their production. On a day-to-day basis, the operational planning system of the main plant sends orders to the suppliers to ensure the availability of components, sub-assemblies and others, such as resources needed for its manufacturing and assembly process.

ISO 15531 addresses the type of information described above. It is does not standardise the model of the manufacturing process. The aim of ISO 15531 is to provide a standardised data model for representing manufacturing management data. Its purpose is to facilitate the integration between the numerous industrial applications by means of common, standardised software that is able to represent these three sets of data.

ISO 15531 is organised as a series of parts, each published separately. The parts of ISO 15531 fall into the following series: production data for external exchange, manufacturing resources usage management data, time model management and manufacturing flow management data.

This part of ISO 15531 addresses the representation of data related to manufacturing flow and process management, through the development of a data model of the manufacturing flows and processes. Particular attention has been paid in the development of this part of ISO 15531 to the relation with the other standards developed in ISO TC184/SC4, such as ISO 10303, ISO 13584, ISO 15926. In addition to the fact that this part of ISO 15531 is developed using EXPRESS language (see ISO 10303-11: 2004) Edition 2, it makes extensive use of several constructs of ISO 10303-41, and references ISO 13584 dictionaries.

Industrial automation systems and integration — Industrial manufacturing management data — Part 43: Manufacturing flow management data: Data model for flow monitoring and manufacturing data exchange

1 Scope

This part of ISO 15531 provides a data model for flow management, and a related set of building blocks, from which are specified standardized data models and representations for the planning, scheduling, controlling and monitoring of material and informational flows. This is in contrast with ISO 15531-42, which provides a time model only.

Consequently this part of ISO 15531 provides a representation of data related to flow control and management in manufacturing, through the development of a conceptual flow model.

The following are within the scope of this part of ISO 15531:

— representation of data related to the management and control of manufacturing flows.

NOTE – This information is usually provided within the main plant, and exchanged among the different machine tools, or production cells.

The following are outside the scope of this part of ISO 15531:

— modelling of information related to the external exchanges;

— modelling of information related to the resource usage made during the manufacturing processes;

— modelling of the information related to the representation of the time.

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO/IEC 8824-1, *Information technology – Abstract Syntax Notation One (ASN.1) - Part 1: Specification of basic notation*

ISO 10303-1, *Industrial automation systems and integration – Product data representation and exchange - Part 1: Overview and fundamental principles*

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

ISO 10303-41, *Industrial automation systems and integration – Product data representation and exchange – Part 41: Integrated generic resources: Fundamentals of product description and support*

ISO 10303-49, *Industrial automation systems and integration – Product data representation and exchange – Part 49: Integrated generic resources: Process structures and properties*

ISO 13584-1, *Industrial automation systems and integration – Parts library – Part 1: Overview and fundamental principles*

ISO 13584-24, *Industrial automation systems and integration – Parts library – Part 24: Logical resource: Logical model of supplier library*

ISO 15531-1, *Industrial automation systems and integration – Industrial manufacturing management data – Part 1:General overview*

ISO 15531-31: 2004, *Industrial automation systems and integration – Industrial manufacturing management data – Part 31: Resource information model*

ISO 15531-32, *Industrial automation systems and integration – Industrial manufacturing management data: Resources usage management – Part 32: Conceptual model for resources usage management data*

ISO 15531-42, *Industrial automation systems and integration – Industrial manufacturing management data – Part 42 : Time model*

IEC 62264-1 : 2003, *Enterprise-control system integration ─ Part 1 : Models and terminology*

3   Terms, definitions, and abbreviations

3.1   Terms and definitions

For the purposes of this document, the following definitions apply:

3.1.1
capability
quality of being able to perform a given activity

NOTE The capability is defined by a group of characteristics that describes functional aspects of manufacturing resources or system.

[ISO 15531-1]

3.1.2
capacity
capability of a system, sub-system or resource to perform its expected function from a quantitative point of view

EXAMPLE The capacity of a system or a resource to produce a given quantity of output in a particular time period.

NOTE For a given system or resource the distinction between capacity available and capacity requested may be

useful.

[ISO 15531-1]

3.1.3
carrying process
transportation process
process that supports flows between other processes

NOTE The other processes may be manufacturing processes and/or other carrying processes. A carrying process is a specialisation of process, it may also be considered as a specialisation of manufacturing process. Nevertheless in the context of flow management a clear distinction shall be made between processes that support directly the manufacturing and process that are more logistic and facilities-oriented.

3.1.4
data
representation of information in a formal manner suitable for communication, interpretation, or processing by human beings or computers

[ISO 10303-1]

3.1.5
data exchange
storing, accessing, transferring, and archiving of data

[ISO 10303-1]

3.1.6
device
any identified physical equipment, system or subsystem that does not belong to software, data set or human resource class

NOTE A device may nevertheless include software.

[ISO 15531-1]

3.1.7
discrete manufacturing
production of discrete items

EXAMPLE Cars, appliances or computer.

[ISO 15531-1]

3.1.8
division process
carrying process that divides flows into more flows

3.1.9
entity
class of information defined by common properties

[ISO 10303-11]

3.1.10
enterprise entity
any concrete or abstract thing in the universe of discourse of an enterprise

NOTE   The concept provided here belongs to the broader concept of entity as defined in ISO 15704 [2]. The concept of entity as defined in those standards has been restricted here to avoid inconsistency with the term of entity as defined in ISO 10303-11. Then excepted in the definition of universe of discourse the term entity applies in ISO 15531 with the definition provided by ISO 10303-11.

[ISO 15531-1]

3.1.11
environment
part of the universe of discourse that does not belong to the system itself

EXAMPLE Inputs and outputs of the systems, such as raw material, final products etc., belong to the environment of the system as well as constraints that apply to it or time

[ISO 15531-42]

3.1.12
flow
motion of a set of physical or informational objects in space and time

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[ISO 15531-1]

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48649fb4f7f7/iso-15531-43-2006

3.1.13
flow control
specific production control system that is based primarily on setting production rates and feeding work into production to meet these planned rates, then monitoring and controlling production

NOTE   That includes the act of checking and driving the flow according to a given purpose. The term may also apply to the function or service. Definition adapted from APICS dictionary [5].

[ISO 15531-1]

3.1.14
flow model
representation or description of manufacturing-related flows describing only the aspects relevant for its purpose

[ISO 15531-1]

3.1.15
information
facts, concepts, or instructions

[ISO 10303-1]

3.1.16
junction process
carrying process that enables the grouping of several flows into one or more other flows

3.1.17
manufacturing
function or act of converting or transforming material from raw material or semi-finished state to a state of further completion

NOTE Definition adapted from APICS dictionary [5].

[ISO 15531-1]

3.1.18
manufacturing management
function or act of directing or regulating the flows of goods through the entire production cycle from requisitioning of raw materials to the delivery of the finished product, including the impact on resources management

[ISO 15531-1]

3.1.19
manufacturing process
structured set of activities or operations performed upon material to convert it from the raw material or a semifinished state to a state of further completion

NOTE Manufacturing processes may be arranged in process layout, product layout, cellular layout or fixed position layout. Manufacturing processes may be planned to support make-to-stock, make-to-order, assemble-to-order, etc., based on strategic use and placements of inventories.

[ISO 15531-1]

3.1.20
model
representation or description of an entity or a system, describing only the aspects considered to be relevant for its purpose

NOTE Entity is not used here with the meaning provided by ISO 10303-11 but with the sense usually given in ISO 15704 [2]

[ISO 15531-1]

3.1.21
operation
job or task consisting of one or more work elements, usually done essentially in one location

NOTE Definition from APICS dictionary [5].

3.1.22
planning
analysis and design of the sequence of processes, of the resource requirements and flow management constraints needed to achieve a given operation

[ISO 10303-1]

3.1.23
process
structured set of activities involving various enterprise entities, that is designed and organised for a given purpose

NOTE The definition provided here is very close to that given in ISO 10303-49. Nevertheless ISO 15531 needs the notion of structured set of activities, without any predefined reference to the time or steps. In addition, from the point of view of flow management, some empty processes may be needed for a synchronisation purpose although they are not actually doing anything (ghost task).

[ISO 15531-1]

3.1.24
product
thing or substance produced by a natural or artificial process

[ISO 10303-1]

3.1.25
product data
representation of information about a product in a formal manner suitable for communication, interpretation, or processing by human beings or by computers

[ISO 10303-1]

3.1.26
resource
any device, tool and means, excepted raw material and final product components, at the disposal of the enterprise to produce goods or services

NOTE 1   Resources as they are defined here include human resources considered as specific means with a given capability and a given capacity. Those means are considered as being able to be involved in the manufacturing process through assigned tasks. That does not include any modelling of an individual or common behaviour of human resource excepted in their capability to perform a given task in the manufacturing process (e.g.: transformation of raw material or component provision of logistic services). That means that human resources are only considered, as the other, from the point of view of their functions, their capabilities and their status (e.g.: idle, busy). That excludes any modelling or representation of any aspect of individual or common «social» behaviour.

NOTE 2 This definition includes ISO 10303-49 definition.

[ISO 15531-1]

3.1.27
scheduling
act, function or result of planning occurrences of manufacturing activities

[ISO 15531-1]