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Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities —

Part 13: Integrated asset planning life-cycle

Systèmes d'automatisation industrielle et intégration — Intégration de données de cycle de vie pour les industries de "process", y compris les usines de production de pétrole et de gaz —

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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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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 15926 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

ISO 15926 is an International Standard for the representation of process industries facility life-cycle information. This representation is specified by a generic, conceptual ontology that is suitable as the basis for implementation in a shared database or data warehouse. This ontology is defined in ISO 15926-2, and has an OWL (Web Ontology Language) representation defined in ISO/TS 15926-12. ISO 15926-2 and ISO/TS 15926-12 are intended to be used as a foundation for domain specific extensions defined in other parts of ISO 15926.

The ontology is designed to be used in conjunction with reference data, i.e. standard instances that represent information common to a number of users, production facilities, or both. The support for a specific life-cycle activity depends on the use of appropriate reference data in conjunction with the ontology.

This document specifies an extension to the generic, conceptual ontology to support integrated planning for assets throughout their life-cycle. The ontology enables the integration of planning data from different sources within a company database.

The ontology is represented in OWL. This document also specifies an XML schema definition (XSD) for a machine-readable exchange of data used for asset planning.

Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities —

Part 13: Integrated asset planning life-cycle

1 Scope

This document specifies an ontology for asset planning for process plants, including oil and gas production facilities. In addition, it specifies an XML schema, derived from the ontology, for exchange of data used for asset planning.

The following are within the scope of this document:

— portfolio, programme and project plans and schedules;

— operational modification and ongoing maintenance plans and schedules;

— calendars for plan execution;

— constraints on the temporal relationships between items within plans and schedules, including succession link, lag, free and total float;

— activity breakdown structures;

— locations of activities;

— resources required, including material, equipment and human resources, and their costs;

— interfaces to systems that process work orders and purchase orders;

— responsible organizations and people;

— progress tracking and resource usage;

— reference to standard classes of facility, activity and resource.

EXAMPLE Standard classes are defined in ISO 19008.

The following are outside the scope of this document:

— standard classes of facility, activity and resource;

NOTE ISO 19008 contains such standard classes.

— production planning;

— plan simulation and optimization;

— hazard identification and risk analysis;

— manning and training of personnel;

— budgeting and cost allocation.

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.

ISO/TS 15926-12:2018, *Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities — Part 12: Life-cycle integration ontology*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TS 15926-12 and the following 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/

3.1.1
activity
individual that is something happening or changing

Note 1 to entry: The ISO/IEC/IEEE 15288:2015 definition of “activity” as “set of cohesive tasks of a process” implies a hierarchy in which processes contain activities, and activities contain tasks. Within this document, all are activities.

Note 2 to entry: The definition in the PMI Lexicon of Project Management Terms states that “activity” is an element of work performed during the course of a project. An activity normally has an expected duration, an expected cost, and expected resource requirements. Activities can be subdivided in tasks.

[SOURCE: ISO/TS 15926-12:2018, 3.1.1, modified — Notes to entry have been added.]

3.1.2
asset planning
planning that is for the construction, commissioning, refurbishment, maintenance, decommissioning, and disposal of assets, including the running down and starting up of production by assets

3.1.3
baseline schedule
schedule that is used by a planning activity as a reference basis for comparison to monitor and control progress on the planned activity

Note 1 to entry: The PMI Lexicon of Project Management Terms defines baseline schedule as “the approved version of a schedule model that can be changed using formal change control procedures and is used as the basis for comparison to actual results”.

Note 2 to entry: A baseline schedule is a specialization of the ISO/IEC/IEEE 15288:2015 definition of “baseline” as “formally approved version of a configuration item, regardless of media, formally designated and fixed at a specific time during the configuration item's life-cycle”.

[SOURCE: ISO 21500:2012, 2.3, modified]

3.1.4
calendar
pattern of working days and shifts that are available for scheduled activities

3.1.5
current schedule
schedule of the planned activity that is currently specified as the agreed working schedule by a planning activity to the performer of the planned activity

Note 1 to entry: ISO 21500:2012 specifies that the role of a current schedule is to avoid adverse schedule impact.

3.1.6
decision gate
activity that approves continuation

Note 1 to entry: Continuation of work beyond a decision gate is contingent on the agreement of the decision-makers.

Note 2 to entry: Criteria for continuation of abandonment are established for each decision gate.

3.1.7
early finish
earliest possible point in time when the uncompleted portions of the activity can finish based on the schedule

[SOURCE: PMI Lexicon of Project Management Terms]

3.1.8
early start
earliest possible point in time when the uncompleted portions of the activity can start based on the schedule

[SOURCE: PMI Lexicon of Project Management Terms]

3.1.9
finish to finish
successor relationship in a plan that is from the finish of one activity to the finish of the next

3.1.10
finish to start
successor relationship in a plan that is from the finish of one activity to the start of the next

3.1.11
free float
period of time into which an activity in a plan can overrun without causing a delay to subsequent activities in the plan

3.1.12
frontline date
date on which the achieved progress on an activity was scheduled

3.1.13
lag
period in time that is specified for a plan succession link

Note 1 to entry: This corresponds to the attributes “lead” and “lag” which are defined in ISO 21500:2012.

3.1.14
late finish
latest point in time that an activity can finish based on the schedule

3.1.15
late start
latest point in time that an activity can start based on the schedule

3.1.16
live schedule
schedule that has been revised from the current schedule to mitigate any delays

3.1.17
managed programme of work
activity that contains management and planning for the whole

3.1.18
milestone
event that is significant in a project, programme of work, or portfolio

[SOURCE: PMI Lexicon of Project Management Terms]

3.1.19
ontology
formal statement of an understanding of the world

Note 1 to entry: An ontology can be represented in any language. It need not be represented in a language specifically designed for ontologies, such as OWL. An ontology can have different representations.

Note 2 to entry: An ontology does not specify what data need to be recorded about the world.

Note 3 to entry: The ontology defined by this document is principally concerned with the world outside a computer system.

[SOURCE: ISO/TS 15926-12:2018, 3.1.3]

3.1.20
plan
specification of how an activity will be done

Note 1 to entry: A plan can include the following:

— a breakdown into component activities;

— resources required by component activities;

— durations of component activities;

— required dates for milestones;

— succession relationships and lags between component activities;

— calendars for activities, resources and lags;

— start and end dates for component activities.

Note 2 to entry: An unscheduled plan does not contain start and end dates for component activities. A schedule does contain start and end dates for component activities.

Note 3 to entry: Plan corresponds to the term design (noun) defined in ISO/IEC/IEEE 15288:2015, where the design is for an activity rather than for a system or system element.

Note 4 to entry: A plan can be more or less detailed.

Note 5 to entry: The PMI Lexicon of Project Management Terms defines “project management plan” as “the document that describes how the project will be executed, monitored and controlled, and closed.”

3.1.21
plan succession link
succession relationship between one activity or milestone and the next in a plan

Note 1 to entry: A plan succession link has the attributes “lead” and “lag” which are defined in ISO 21500:2012.

3.1.22
planning
activity that is creating a plan

Note 1 to entry: Planning corresponds to the term design (verb) defined in ISO/IEC/IEEE 15288:2015, where a plan for an activity, rather than a design for a system or system element, is created.

3.1.23
project
activity with defined start and finish criteria undertaken to create a product or service in accordance with specified resources and requirements

Note 1 to entry: A continuing operational activity is not a project.

Note 2 to entry: A project has a beginning and end, and can be constrained by available time, funding and resources.

Note 3 to entry: In many cases an activity that is planned consists of parts of different projects with different objectives. Therefore the activity is not a project.

Note 4 to entry: Product here is a result of the project activity, not directly related to Product Breakdown Structure.

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.33, modified — The word "endeavour" has been replaced with "activity" at the start of the definition and the Notes to entry have been modified.]

3.1.24
resource
individual that is used to perform an activity

Note 1 to entry: A resource can be material or staff time or equipment.

3.1.25
revised schedule
schedule that has been revised from the current schedule

3.1.26
revision shutdown
shutdown that is in order to make a change to a production activity

3.1.27
schedule
specification of an activity that contains all that is required as a basis for execution, and that specifies start and end dates for component activities

Note 1 to entry: A schedule is the end product of a planning activity at a point in time. A schedule can be revised as a project progresses.

Note 2 to entry: A schedule includes calendars, succession relationships, and all other constraints.

3.1.28
standard class
class whose specification for membership is owned or controlled by a standardization body and is publicly available

[SOURCE: ISO 15926-1:2004, 3.1.2, modified — The Note to entry and examples have been deleted.]

3.1.29
start to finish
successor relationship in which a successor activity cannot finish until a predecessor activity has started

3.1.30
start to start
successor relationship in which a successor activity cannot start until a predecessor activity has started

3.1.31
subject of work
physical object that an activity is carried out upon

3.1.32
total float
period of time into which an activity in a plan can overrun without causing a delay to the completion of the plan as a whole

3.1.33
work order
managed programme of work that contains a request from one party to another for one or more activities to be performed

3.2 Abbreviated terms

COR	Code Of Resources
EF	Early Finish
ES	Early Start
FF	Finish to Finish
FNET	Finish No Earlier Than
FNLT	Finish No Later Than
FS	Finish to Start
LF	Late Finish
LS	Late Start
MFO	Must Finish On
MSO	Must Start On
OMG	Object Management Group
OWL	Web Ontology Language
PBS	Physical Breakdown Structure
RDF	Resource Description Framework
RDL	Reference Data Library
SAB	Standard Activity Breakdown
SAWSDL	Semantic Annotations for WSDL and XML Schema
SF	Start to Finish
SKOS	Simple Knowledge Organization System
SNET	Start No Earlier Than

SNLT	Start No Later Than
SS	Start to Start
TURTLE	Terse RDF Triple Language
UML	Unified Modeling Language
IRI	Internationalized Resource Identifier
UTC	Coordinated Universal Time
W3C	The World Wide Web Consortium
XML	eXtensible Mark-up Language
XSD	XML Schema Definition

3.3 Symbols

This document contains examples with diagrams which show instantiations of ISO 15926. The concise notation is used for these diagrams as defined in Figure 1.

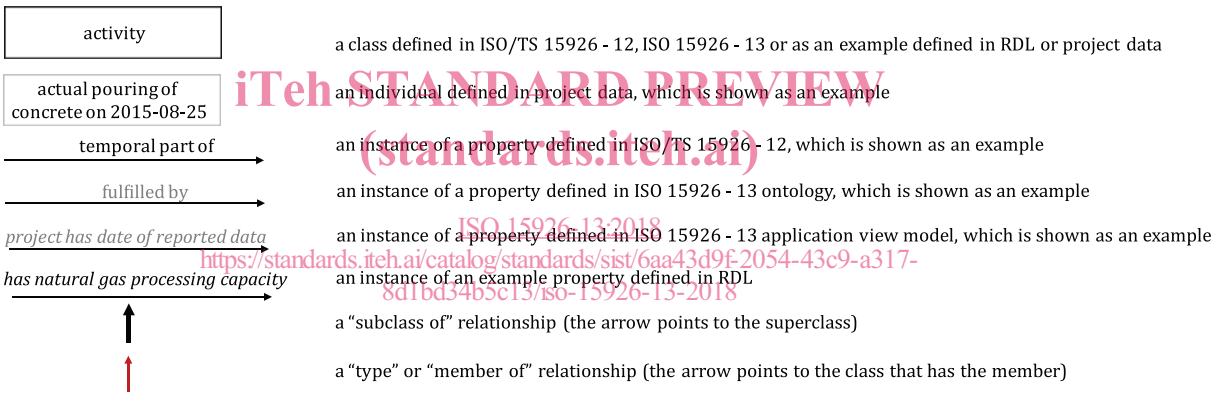


Figure 1 — Notation for the ISO 15926 instantiation examples

NOTE ISO/TS 15926-12 implements the ISO 15926-2 entity **composition of individual** by the OWL object properties **lci:hasPart** and **lci:partOf**. ISO/TS 15926-12 partially implements the ISO 15926-2 entity **class of composition of individual** by the OWL object properties shown in Figure 2.

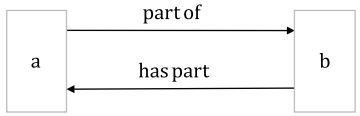
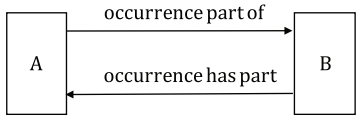
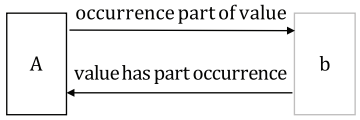
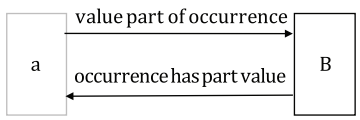
	**possible individual** 'a' is part of **possible individual** 'b'
	each member of **class of individual** 'A' is part of a member of **class of individual** 'B' and each member of **class of individual** 'B' has a member of **class of individual** 'A' as a part
	each member of **class of individual** 'A' is part of **possible individual** 'b'
	each member of **class of individual** 'B' has **possible individual** 'a' as a part

Figure 2 — Naming convention for composition and class of composition

The naming convention is used as follows:

— the **activity** 'actual pouring of concrete for the refurbishment of facility F-101' has **part of** relationship with the **activity** 'actual refurbishment of facility F-101';

— the **plan for activity** (a class) 'plan for pouring of concrete for the refurbishment of facility F-101 version 2' has an **class part of occurrence** relationship with the **plan for activity** 'plan for the refurbishment of facility F-101 version 2'.

The use of the composition properties is shown in Figure 3.

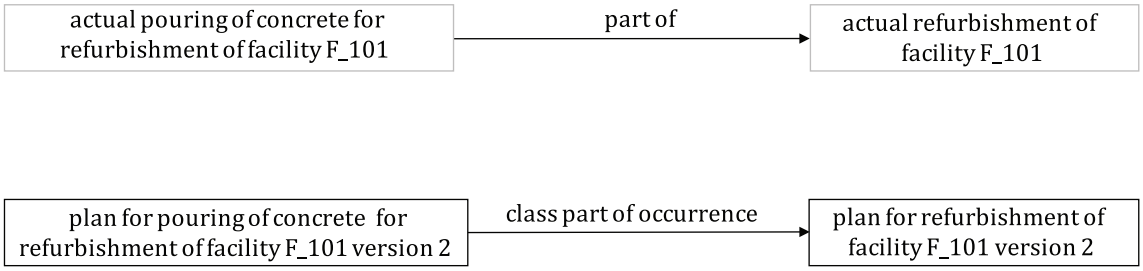


Figure 3 — Use of composition properties

4 Layers and extension of integrated asset planning life-cycle data

4.1 Layers for integrated asset planning life-cycle data

The approach to integrated asset planning life-cycle data defined by this document has the layers shown in Figure 4.

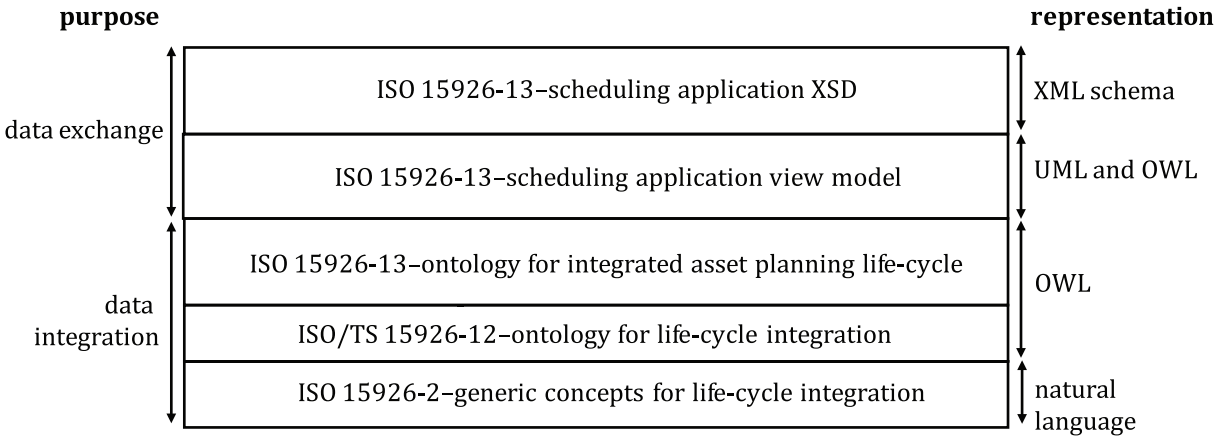


Figure 4 — Layers for integrated asset planning life-cycle

These layers are as follows:

— ISO 15926-2 defines the concepts that support the representation of engineering data throughout its life-cycle;

— ISO/TS 15926-12 represents the concepts defined in ISO 15926-2 using OWL;

— the ontology in this document imports ISO/TS 15926-12 and extends it with additional concepts required for planning.

This ontology can be used to define a database of planning data.

— The scheduling application view model in this document defines an external view of planning data that is appropriate for scheduling applications. This view model has a limited scope with a defined set of properties.

The view model is expressed as UML diagrams, and in a scheduling application view ontology. This view ontology defines classes with epistemological constraints and template properties that hide objects which are not part of the view.

— The scheduling application XML schema in this document defines a physical file format for exchange between scheduling applications or between a scheduling application and a database of planning data. The XML schema is derived by algorithm from the OWL representation of the scheduling application view model.

4.2 The documentation of the layers

The documentation of the layers, starting at the bottom of Figure 4, is as follows.

— **Ontology for integrated asset planning life-cycle**: The planning ontology is described in Clause 5. Implementation of the planning ontology in OWL shall use the representation of the ontology in Clause A.1.

NOTE 1 This clause contains numerous examples.

— **Scheduling application view model**: The scheduling application view is described in Clause 6. Implementation of the scheduling application view in OWL shall use the representation of the ontology in Clause A.3.

NOTE 2 Although the scope of the ontology within this document is greater than that of the view, this clause can serve as an introduction to this document as a whole. The data planning diagrams in 6.4 are especially useful as an introduction.