INTERNATIONAL STANDARD

ISO 15926-10

First edition
2019-12

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

Part 10: Conformance testing

Reference number
ISO 15926-10:2019(E)

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Published in Switzerland

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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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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

This document demonstrates specified requirements of conformance to ISO 15926.

The target audiences for this document are as follows:

— users of a software product wishing to determine whether a software product deployed and/or a deliverable of the software product fulfils the specified requirements to conform to ISO 15926;

NOTE 1 Users typically include, but are not limited to, plant owners, project management contractors, front end engineering design contractors, engineering procurement construction contractors, original equipment manufacturing suppliers, catalogue providers, commissioning engineers, information technology engineers, and information management engineers.

— implementers wishing to determine whether a software product developed and/or a deliverable of the software product fulfils the specified requirements to conform to ISO 15926.

NOTE 2 Implementers include, but are not limited to, software engineers working for commercial software product development companies, and software engineers working on industrial businesses using their developed software product.

Users of this document are expected to have an understanding of conceptual data models, of the ISO 15926 series, of the ISO/TS 18876 series and of ISO/IEC/IEEE 15288.

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

Part 10: Conformance testing

1 Scope

This document defines the principles and methods for conformance testing of software implementations of ISO 15926.

It provides guidance for developing test cases and testing procedures that cover the requirements specified in the ISO 15926 series and in different industry usage contexts, e.g. data exchange, use of reference data libraries and interface services.

This document provides guidance in addition to the conformance in the parts.

NOTE 1 Guidance on conformance ISO 15926 testing of complex scenarios which represent integrated interoperability is outside the scope of this document.

NOTE 2 Guidance on the development of software that supports the way of file exchange in the simple scenario which represents unified interoperability is outside the scope of this document.

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/ui

— IEC Electropedia: available at http://www.electropedia.org/

3.1
conformance testing
process to determine whether an implementation meets the requirements of a standard

3.2
specified requirement
need or expectation that is stated

3.3
functional approach
series of three functions that satisfy a need or demand for a demonstration that *specified requirements* (3.2) are fulfilled

Note 1 to entry: The three functions are selection, determination, and review and attestation.

3.4
software implementation layer
conceptual model that characterizes the software implementation

3.5
information exchange layer
particular conceptual model based on the *software implementation layers* (3.4) that characterizes the information exchange between computing system

3.6
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 shall be recorded about the world.

Note 3 to entry: The ontology defined by this part of ISO 15926 is principally concerned with the world outside a computer system.

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

4 Principles and methods

4.1 Conformance testing

Conformance testing of software implementations of ISO 15926 (conformance to the ISO 15926 series) shall be performed according to the functional approach, which is described in ISO/IEC 17000.

The testing can be done by first, second and/or third party.

NOTE The adoption of ISO/IEC Guide 60 can build the credibility of conformance testing.

4.2 Conformance to the ISO 15926 series

4.2.1 Conformance to ISO 15926-1

Conformance testing of software implementations of ISO 15926 means conformance to ISO 15926-1, if and only if all the requirements stated by the users of a software product and/or the implementer are fulfilled. A statement of conformance shall be prepared to state all means of communicating that the fulfilment of specified requirements has been successfully demonstrated.

ISO 15926-1 describes the activity, activity analysis, and modelling methods. The ISO 15926-1 activity model is shown in Figure 1.

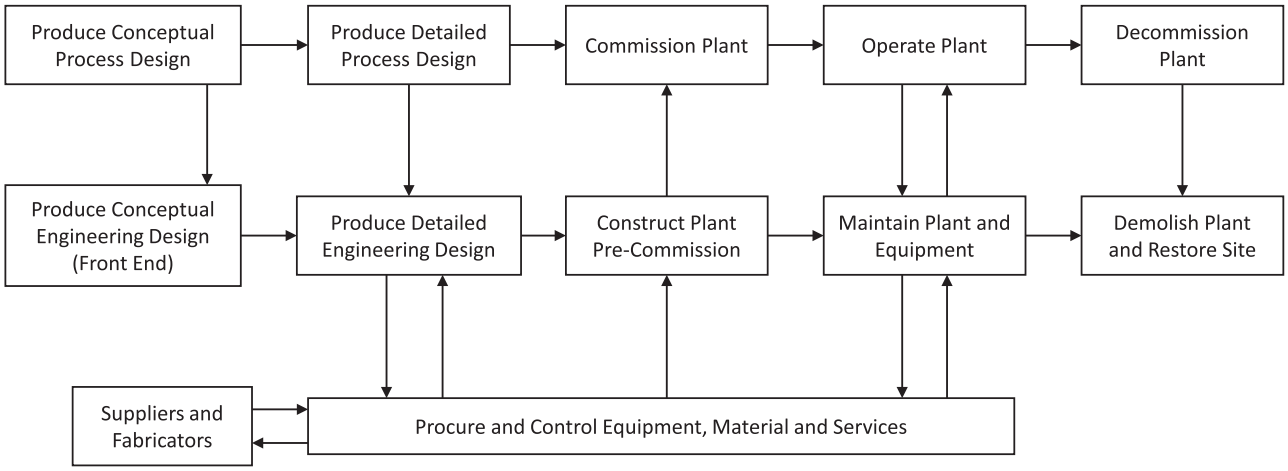

Figure 1 — ISO 15926-1 activity model

4.2.2 ISO 15926-1 conformance scenarios

Within the ISO 15926-1 activity model, there is a domain and range of scenarios, each of which results in various complexity of the software implementations of ISO 15926:

— scenario of handover, including sending and receiving files conforming to parts of ISO 15926;

— scenario of integration including using software programs that support the full span of design, engineering, construction, operation, and maintenance.

For each scenario, the following information shall be collected and recorded, but not limited to:

— overview (of scenario conformance);

— general (of the scenario of the annex and systems involved);

— procedure (steps of the workflow of handover or integration);

— aspects to be validated (verification);

— detailed validation (verification);

— not in scope (define what is not included in the workflow steps but useful to know).

Conformance testing of software implementations of ISO 15926 shall be executed in accordance with the scenario. Moreover, by applying the functional approach, the scenario shall demonstrate that the commissioned system fulfils specified requirements.

To perform the functional approach, the following activities, but not limited to, shall be conducted:

— selection (of information): planning and preparation activities to collect and produce all information and input needed for the subsequent determination functions;

— determination (gather evidence): developing complete information regarding fulfilment of the specified requirements by the object of conformity assessment or its sample;

— review (of evidence) and attestation (to conformity): constituting the final stage of checking before taking the important decision as to whether the purpose of conformity assessment has been reliably demonstrated to fulfil the specified requirements.

The specific application of the functional approach shall be documented by the conformance testing plan.

An appropriate set of validation and/or verification rules shall be selected and applied by referring to Annexes A, B, C, D, E and F. The candidate set of verification rules shall include, but not be limited to, the following (see Figure 3):

— all applications at layer 1 shall adopt Annex A;

— all applications at layer 2 shall adopt Annex B;

— an applications at layer 3 that claims conformance to ISO/TS 15926-7 and ISO/TS 15926-8 shall refer to Clause 5 for the description of the methodology and adopt the conformance rules given in Annex C;

— an application at layer 3 that claims conformance to ISO/TS 15926-11 shall refer to Clause 6 for the description of the methodology and adopt the conformance rules given in Annex D;

— an application at layer 3 that claims conformance to ISO/TS 15926-12 shall adopt Annex E;

— an application at layer 3 that claims conformance to ISO 15926-13 shall adopt Annex F.

NOTE This selection of annexes can be interpreted as conformance clauses used in the ISO 10303 series. Moreover, the particular selection of annex to test the conformance can be described as the conformance class of the particular part of the ISO 15926 series.

4.2.3 Conformance testing in accordance with ISO 15926-1

The software implementation of ISO 15926 consists of four layers. For each selected layer, the specific functional approach in accordance with the following shall be applied.

— Role and scope of the software implementation (layer 1): This is to define the "what" portion of the software implementation of ISO 15926 in terms of the role and scope. Based on the activity model in ISO 15926-1, actual placement of the role and scope will be identified. The conformance testing plan or its equivalent shall be documented. Role and scope shall be examined by referring to Annexes A and B.

— Content of the software implementation (layer 2): The particular content of the software implementation of ISO 15926 shall be defined based on information defined in above layer 1. It is the layer where the particular information and/or product model(s) referring the entities and relationships of ISO 15926-2 and accompanying domain and range of ISO/TS 15926-4 or relent reference data library (RDL) based on ISO/TS 15926-6 (the whole integration model) shall be defined and assessed. Use of context shall be examined by referring Annexes A and B.

— Semantics of the software implementation (layer 3): The particular semantics of the software implementation shall be designed by selecting the preferred combination of the part(s) of the ISO 15926 series. Both the source and target application shall be mapped to the particular information and/or product model(s) defined in the above layer 2. Use of semantic shall be examined by referring to Annexes C to F.

— Syntax and storage of the software implementation (layer 4): The syntax and storage shall be defined by the actual implementation of language and storage of the preferred part(s) of the ISO 15926 series. Conformance testing can test, but not limited to, correct use of syntax, URI, and model which are defined in selected implementation languages.

At each layer, conformance testing of a software implementation of ISO 15926 shall be conducted to see if a particular commissioned system meets the user requirements. Furthermore, depending on the software implementation layer, conformance rules defined in accompanying annexes shall be selected and used to determine the conformance, and reviewed and attested the results as a part of the conformance. See Table 1 for an overall summary.

Table 1 — Software implementation layer of ISO 15926 and conformance testing

Software implementation layer of ISO 15926	What required and what rules to be selected	What to be validated and/ or verified
Role and scope (Layer 1)	Business Requirements and selecting handover or integration schema.	Validate quality (usability, completeness, and consistency) of a handover or integration schema.
Content (Layer 2)	RDL content management requirements and selecting relevant Reference Data Items for handover or for an integration scheme.	Verify whether the Reference Data Items are indeed available for the selected handover or integration scheme.
Semantics (Layer 3)	Semantic requirements and selecting appropriate ISO 15926 part(s) for handover or integration.	Verify correctness of the semantic interpretation of data for handover or integration.
Syntax and storage (Layer 4)	Technological requirements and selecting appropriate serialization and data for handover or integration technology.	Verify correctness serialization and data for handover or integration technology

The layer model is valid both for integrated interoperability and for unified interoperability, as described in ISO 11354-1. The integrated approach assures consistency and coherence of the interoperating subsystems by focusing on the (software) components that need to interact. These components are then designed and implemented using a common standard so that interoperability is seen as a designed-in quality. Interoperation between these various components is therefore obtained a priori without any interfacing effort. The choice of interoperability has a significant impact on the practical interpretation of Table 1.

This document deals with the so-called "simple scenario" of exchange of a file which follows the unified interoperability approach, as described in ISO 11354-1. The unified interoperability approach uses a common meta-level structure that shall be identified and detailed applicable for the participating parties. This structure shall provide a means for semantic equivalence to allow mapping between entities. Using this meta-level structure, a translation between the constituent entities is then possible.

More complex scenarios aiming at integrated interoperability, are not covered in this document.

4.3 Simple scenario

4.3.1 Overview

The general process of data exchange in the context of ISO 15926 is explained from a practical point of view of conformance testing of the software implementation to ISO 15926, taking in count the technology available today. This subclause is about data exchange in terms of physically exchanging a file between two parties to exchange explicit, unambiguous asset management information. Development of software that supports this way of file exchange is outside the scope of this document.

4.3.2 Introduction

As an example, the exchange of data in the creation process of an asset owner with a contractor is used in the context of a unified interoperability approach. The principle used in this example is shown in Figure 2. The handover is represented by an envelope containing the payload file.

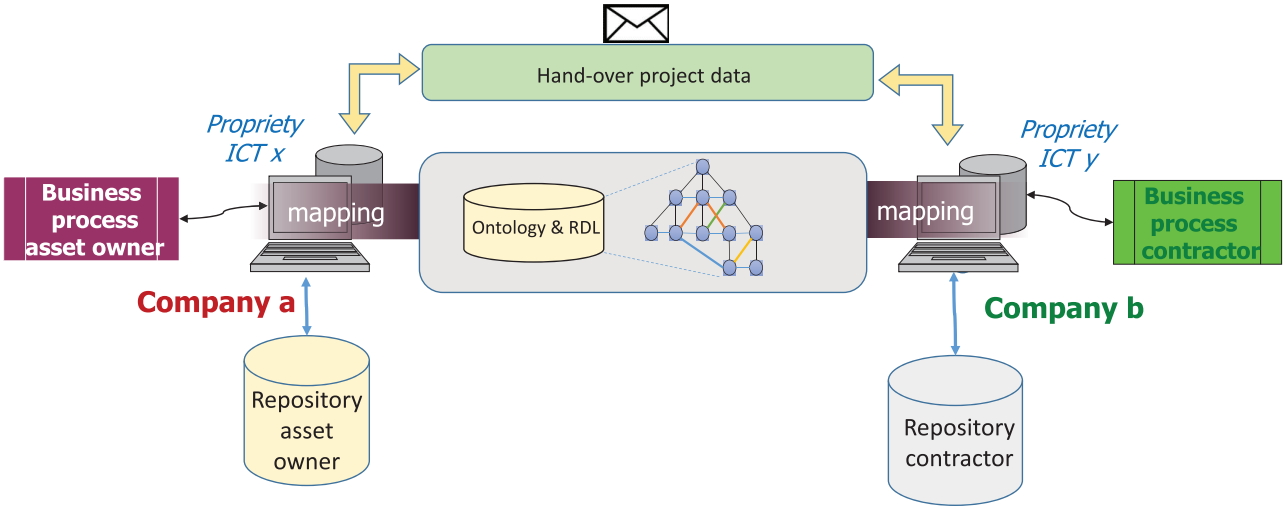

Figure 2 — Principle of data exchange on a commonly shared ontology and RDL

4.3.3 Process steps of the workflow of exchange data

Within this document, a systematic approach using four software implementation layers is presented in Figure 3, in order to organize the exchange process.

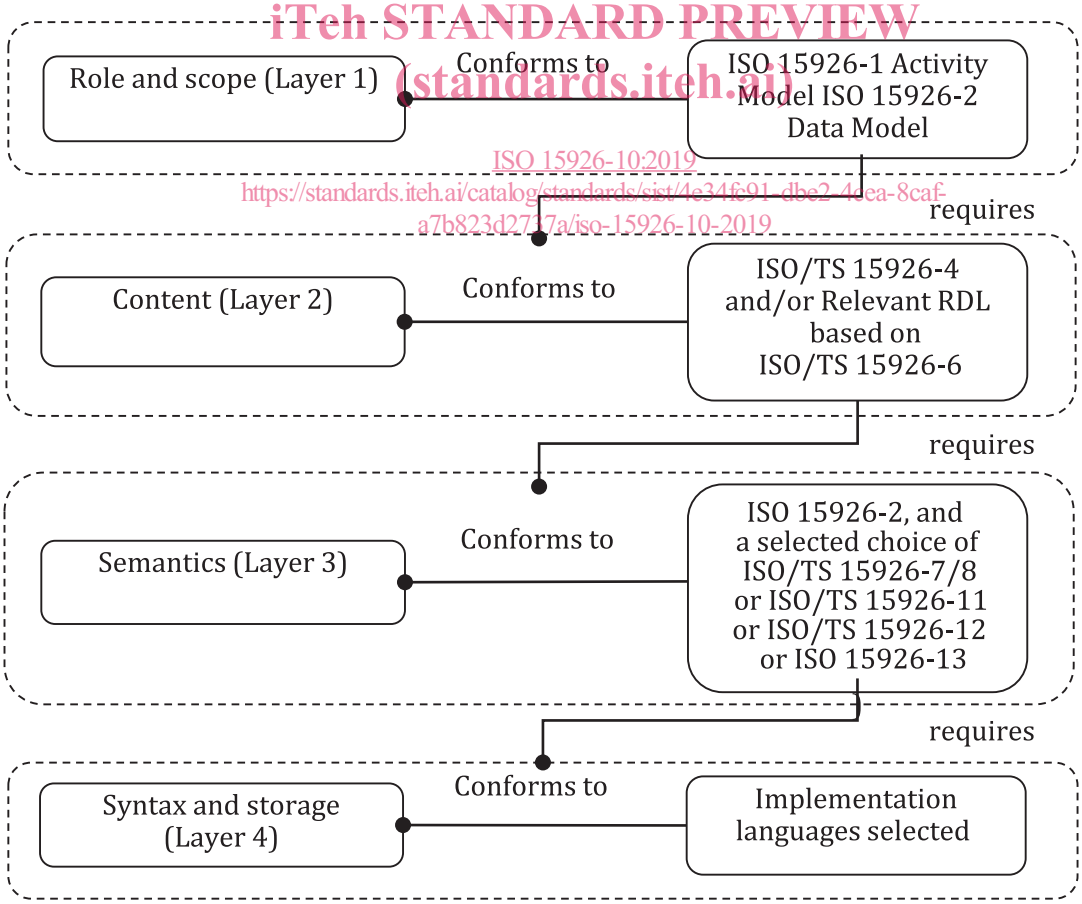

Figure 3 — Layers within the process of data exchange

The four layers are shown in Figure 3 are as follows:

— role and scope of the data exchange (the red arrows in Figure 4);

— content: definitions of the objects that can be found in the exchange file, classified according to the shared RDL;

— semantics (meaning) of the data exchanged defined by the part or parts of ISO 15926 agreed on;

— syntax and storage: the method of serialization and syntax used on the data level.

A step-by-step enumeration of the tasks carried out during a process has been extracted for a chosen scenario. Moreover, it shall fall into some of the following activities executed by the asset owner either the contractor where specific entities, e.g. objects in the context of a specific plant or project shall be determined. This process can be referred to as "role and scope."

Furthermore, once a relevant entity is identified, the relevant RDL items shall be selected.

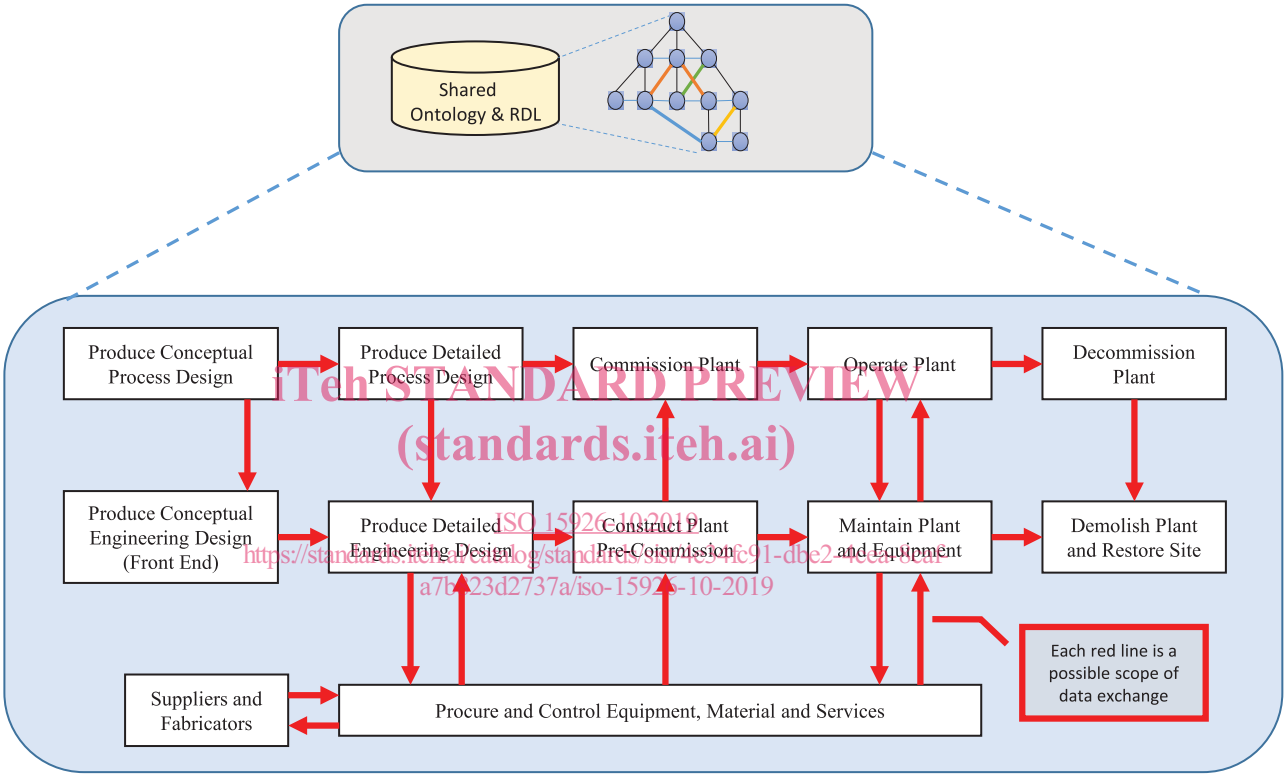

Figure 4 — Activity model as a basis for the selection of role and scope of data exchange

4.3.4 Aspects to be validated

In Figure 5, a scenario is presented where the asset owner, designing a process plant, exchange data with the contractor about this plant in the context of a contract between the asset owner and the contractor about delivering the design made by the contractor to the asset owner.

The total design of the process plant is stored in a repository owned by the asset owner. The contractor does have its repository to store and maintain its design, including all information, not directly relevant for the asset owner.

Within the project, a shared ontology and RDL (both on class level) is agreed and represents the semantics of the design to be stored and exchanged on the data level (content layer in Figure 3).

All objects within both the repository of the asset owner and the contractor are classified as a class in the shared RDL and are identified by commonly used identifiers (UID's, recognized by both plant owner and contractor).