
**Industrial automation systems and
integration — Product data representation
and exchange —**

Part 31:

Conformance testing methodology and
framework: General concepts

ISO 10303-31:1994

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*Systemes d'automatisation industrielle et integration — Représentation
et échange de données de produits —*

*Partie 31: Méthodologie et cadre général pour les essais de conformité:
Concepts généraux*



Contents

	Page
1 Scope	1
1.1 Applicability of this series of parts	1
1.2 Applicability of this part of ISO 10303	1
1.3 Coverage of this series of parts	1
1.4 Coverage of this part of ISO 10303	3
2 Normative references	3
3 Definitions	4
3.1 Terms defined in ISO 10303-1	4
3.2 Other definitions	4
3.2.1 abstract test case (ATC)	4
3.2.2 abstract test group	4
3.2.3 abstract test method	4
3.2.4 (laboratory) accreditation	5
3.2.5 accreditation body	5
3.2.6 assessor	5
3.2.7 attestation of conformity	5
3.2.8 basic tests	5
3.2.9 capabilities of an IUT	5
3.2.10 capability tests	5
3.2.11 certificate of conformance	5
3.2.12 certificate of conformity; certificate of conformance	5
3.2.13 certification body	5
3.2.14 certification mark	5
3.2.15 certification of conformity	6
3.2.16 certification system	6
3.2.17 client (of a testing laboratory)	6
3.2.18 comparability (of results)	6
3.2.19 conformance	6
3.2.20 conformance assessment process	6
3.2.21 conformance log	6
3.2.22 conformance testing	6
3.2.23 (conformance) test report	6

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3.2.24	conforming implementation	6
3.2.25	conformity; conformance	6
3.2.26	control board	6
3.2.27	declaration of conformance	6
3.2.28	declaration of conformity; (manufacturer's) declaration of conformance	7
3.2.29	executable test case	7
3.2.30	executable test suite	7
3.2.31	fail (verdict)	7
3.2.32	falsification testing	7
3.2.33	Implementation Under Test (IUT)	7
3.2.34	inconclusive (verdict)	7
3.2.35	in-house testing	7
3.2.36	manufacturer's declaration of conformance	7
3.2.37	non-conformance	7
3.2.38	non-conformity; non-conformance	7
3.2.39	pass (verdict)	7
3.2.40	PIXIT proforma	8
3.2.41	postprocessor	8
3.2.42	preprocessor	8
3.2.43	proficiency testing	8
3.2.44	Protocol Implementation extra Information for Testing (PIXIT)	8
3.2.45	repeatability (of results)	8
3.2.46	resolution tests	8
3.2.47	selected abstract test suite	8
3.2.48	selected executable test suite	8
3.2.49	System Under Test (SUT)	8
3.2.50	test campaign	8
3.2.51	test case	8
3.2.52	test case error	8
3.2.53	test purpose	9
3.2.54	test realiser	9
3.2.55	test report	9
3.2.56	test verdict	9
3.2.57	testing laboratory	9
3.2.58	(test) verdict	9
3.2.59	verdict criteria	9
3.2.60	verification testing	9
4	Abbreviations	9
5	Conformance	10
5.1	The meaning of conformance in ISO 10303	10
5.2	Conformance requirements	10
5.3	Protocol Implementation Conformance Statement	10
5.4	A conforming system	11
6	Conformance testing	11

6.1	Introduction	11
6.2	Types of conformance tests	11
6.2.1	Basic tests	12
6.2.2	Capability tests	12
6.3	Protocol Implementation eXtra Information for Testing	13
6.4	Conformance assessment process overview	13
6.5	Preparation for testing	14
6.6	Test campaign	16
6.7	Analysis of results	16
6.8	Conformance test report production	16
6.9	Intrinsic properties of the conformance assessment process	17
6.9.1	Repeatability of results	17
6.9.2	Comparability of results	17
6.9.3	Auditability of results	17
7	Abstract test methods	18
8	Abstract and executable test suites	18
8.1	Structure	18
8.2	Test purposes	18
8.3	Abstract test cases	18
8.4	Executable test cases	20
8.5	Relationship between abstract and executable test cases	20
Annexes		
<u>ISO 10303-31:1994</u>		
https://standards.iteh.ai/catalog/standards/sist/50e196b6-2651-42cc-86b3-ch6e0fe3e44a/iso-10303-31-1994		
A	Information object registration	21
B	Optional conformance requirements	22
C	Resolution tests	23
D	Supporting organisations	24
D.1	Introduction	24
D.1.1	Purpose	24
D.1.2	Scope	24
D.1.3	Intended readership	24
D.1.4	Background	25
D.1.5	General philosophy of conformance testing	25
D.2	Responsible authorities	25
D.2.1	Control board	25
D.2.2	Accreditation body	28
D.2.3	Testing laboratory	28
D.2.4	Certification body	29
D.3	Administration and certification	30
D.3.1	Guidelines for role of the certification body	30
D.3.2	Sponsoring a laboratory accreditation programme	30

D.3.3	Conditions for testing laboratory accreditation	31
D.3.4	Criteria for accrediting testing laboratories	31
D.3.5	Testing laboratory assessment	32
D.4	The process of certification	34
D.4.1	Initial contact	34
D.4.2	Certificate of conformity content and presentation	34
D.4.3	National responsibilities	35
D.4.4	International (ISO TC184/SC4) responsibilities	35
E	Bibliography	38
	Index	39
Figures		
1	Relationship between conformance testing standards and other series of parts	2
2	Overview of the conformance assessment process	15
3	Example structure of an abstract test suite	19
D.1	Infrastructure for conformance testing	26
D.2	Sample certificate of conformity	36
D.3	Sample form for additional claims made by the client	37

[ISO 10303-31:1994](https://standards.iteh.ai/catalog/standards/sist/50e196b6-2651-42cc-86b3-eb6e0fe3e44a/iso-10303-31-1994)

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eb6e0fe3e44a/iso-10303-31-1994](https://standards.iteh.ai/catalog/standards/sist/50e196b6-2651-42cc-86b3-eb6e0fe3e44a/iso-10303-31-1994)

Foreword

The International Organization for Standardization (ISO) 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.

Draft International Standards adopted by 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.

International Standard ISO 10303-31 was prepared by Technical Committee ISO/TC 184, *Industrial automation systems and integration*, Subcommittee SC4, *Industrial data and global manufacturing programming languages*.

ISO 10303 consists of the following parts under the general title *Industrial automation systems and integration – Product data representation and exchange*:

- Part 1, Overview and fundamental principles;
- Part 11, Description methods: The EXPRESS language reference manual;
- Part 21, Implementation methods: Clear-text encoding of the exchange structure;
- Part 22, Implementation methods: Standard data access interface specification;
- Part 31, Conformance testing methodology and framework: General concepts;
- Part 32, Conformance testing methodology and framework: Requirements on testing laboratories and clients;
- Part 41, Integrated generic resources: Fundamentals of product description and support;
- Part 42, Integrated generic resources: Geometric and topological representation;
- Part 43, Integrated generic resources: Representation structures;
- Part 44, Integrated generic resources: Product structure configuration;
- Part 45, Integrated generic resources: Materials;
- Part 46, Integrated generic resources: Visual presentation;
- Part 47, Integrated generic resources: Shape variation tolerances;
- Part 49, Integrated generic resources: Process structure and properties;

- Part 101, Integrated application resources: Draughting;
- Part 104, Integrated application resources: Finite element analysis;
- Part 105, Integrated application resources: Kinematics;
- Part 201, Application protocol: Explicit draughting;
- Part 202, Application protocol: Associative draughting;
- Part 203, Application protocol: Configuration controlled design;
- Part 207, Application protocol: Sheet metal die planning and design;
- Part 210, Application protocol: Printed circuit assembly product design data;
- Part 213, Application protocol: Numerical control process plans for machined parts.

The structure of this International Standard is described in ISO 10303-1. The numbering of the parts of this International Standard reflects its structure:

- Part 11 specifies the description methods;
- Parts 21 and 22 specify the implementation methods;
- Parts 31 and 32 specify the conformance testing methodology and framework;
- Parts 41 to 49 specify the integrated generic resources;
- Parts 101 to 105 specify the integrated application resources;
- Parts 201 to 213 specify the application protocols.

Should further parts be published, they will follow the same numbering pattern.

Annex A forms an integral part of this part of ISO 10303. Annexes B, C, D, and E are for information only.

Introduction

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This International Standard is organized as a series of parts, each published separately. The parts of ISO 10303 fall into one of the following series: description methods, integrated resources, application protocols, abstract test suites, implementation methods, and conformance testing. The series are described in ISO 10303-1. This part of ISO 10303 is a member of the conformance testing series.

This part of ISO 10303 introduces the series of parts of ISO 10303 devoted to conformance testing, provides a framework and describes the general concepts for conformance testing of implementations of ISO 10303. This part of ISO 10303 is based in part upon material in ISO 9646-1 which provides the same function for conformance testing in Open Systems Interconnection. The concepts have been modified for use in this particular domain. This part therefore plays a similar role for this series of parts as does ISO 9646-1 for ISO 9646. Subsequent parts concerning conformance testing of implementations of ISO 10303 are also based upon subsequent parts of ISO 9646. ISO 10303-31 applies not only to exchange structures but, with the current knowledge available, to other implementation methods also. Subsequent parts required for the establishment of conformance testing services address:

- requirements on testing laboratories and clients (ISO 10303-32);
- abstract test suites (ISO 10303-33);
- abstract test methods (ISO 10303-34).

This part also incorporates aspects from the development of the ISO 9000 and EN 45000 series of standards and from a number of ISO/IEC guides:

- a) ISO/IEC Guide 2: General terms and their definitions concerning standardization and related activities;
- b) ISO/IEC Guide 25: General requirements for the competence of calibration and testing laboratories;
- c) ISO/IEC Guide 38: General requirements for the acceptance of testing laboratories;
- d) ISO/IEC Guide 40: General requirements for the acceptance of certification bodies;
- e) ISO/IEC Guide 42: Guidelines for a step-by-step approach to an international certification system;
- f) ISO/IEC Guide 43: Development and operation of laboratory proficiency testing;

- g) ISO/IEC Guide 45: Guidelines for the presentation of test results.

The objective of product data exchange cannot be completely achieved unless systems can be tested to determine whether they conform to the relevant product data exchange standards. There is an industrial need to establish conformance testing services for implementations of ISO 10303. This part of ISO 10303 provides a foundation for the subsequent parts in this series which are required to establish conformance testing services and hence, meet that industrial need.

Conformance testing is a type of testing defined as the testing of a candidate product for the existence of specific characteristics required by a standard in order to determine the extent to which that product is a conforming implementation. It involves testing the capabilities of an implementation against both the conformance requirements in the relevant standard(s) and what the client states the implementation's capabilities are.

An abstract test suite is standardised for each application protocol of ISO 10303, for use by suppliers or implementors in self-testing, by users of product data exchange products, or by other third party testing organisations. This should lead to comparability and wide acceptance of test reports produced by different testing laboratories, and thereby minimise the need for repeated conformance testing of the same system.

The standardisation of abstract test suites requires international definition and acceptance of a common test methodology, together with appropriate test methods and procedures. It is the purpose of this series of parts to define the methodology, to provide a framework for specifying abstract test suites, and to define the procedures to be followed during conformance testing.

Details of test methods are addressed in this series of parts; however, any organisation contemplating the use of test methods defined in this series of parts should carefully consider the constraints on their applicability.

Conformance testing does not include some types of testing which may be appropriate for implementations of ISO 10303. These include robustness testing, interoperability testing, acceptance testing and performance testing. These test methods do not form part of conformance testing because there are no appropriate conformance requirements in the standard against which to test. After the results from conformance testing are available, additional testing may be performed.

Conformance testing does not provide judgements on how a system is implemented, how reliable it is, how it provides any requested service, nor the environment of the implementation. It does not, except in an indirect way, prove anything about the logical design of the standard itself.

Conformance is not sufficient to guarantee interoperability; however, it increases the probability that different implementations are able to interoperate. In order to be able to interoperate, it is necessary that two implementations that conform to a given application protocol support compatible options within that application protocol.

The complexity of most standards makes exhaustive testing impractical on both technical and economic grounds. For this same reason of complexity, proof of correctness (verification testing) is also impractical. Falsification testing does not guarantee conformance to a standard since it detects errors rather than the absence of errors. Conformance testing gives confidence that an implementation has the required capabilities.

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Industrial automation systems and integration — Product data representation and exchange — Part 31 : Conformance testing methodology and framework: General concepts

1 Scope

This part of ISO 10303, which introduces the series of parts devoted to conformance testing, specifies a general methodology and framework for testing the conformance of an implementation of ISO 10303. During conformance testing, such an implementation is termed an IUT (implementation under test).

NOTE – Figure 1 is a pictorial representation of the relation between the various standards and some of the concepts of conformance testing. The roles of other parts of ISO 10303 are documented in ISO 10303-1.

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1.1 Applicability of (this series of parts)

This series of parts is applicable to the phases of the conformance testing process, these phases being characterised by the following major activities:

- the definition of abstract test suites for ISO 10303 application protocols;
- the definition of abstract test methods for ISO 10303 implementation methods;
- the conformance assessment process carried out by a testing laboratory for a client, culminating in the production of a conformance test report.

1.2 Applicability of this part of ISO 10303

This part of ISO 10303 is applicable to all of the above activities, providing introductory material, normative requirements on each part of this series, and definitions of common terms and concepts.

1.3 Coverage of this series of parts

This series of parts specifies the requirements for and gives guidance on the procedures to be followed in conformance testing for ISO 10303. This series of parts includes only such information as is necessary to meet the following objectives:

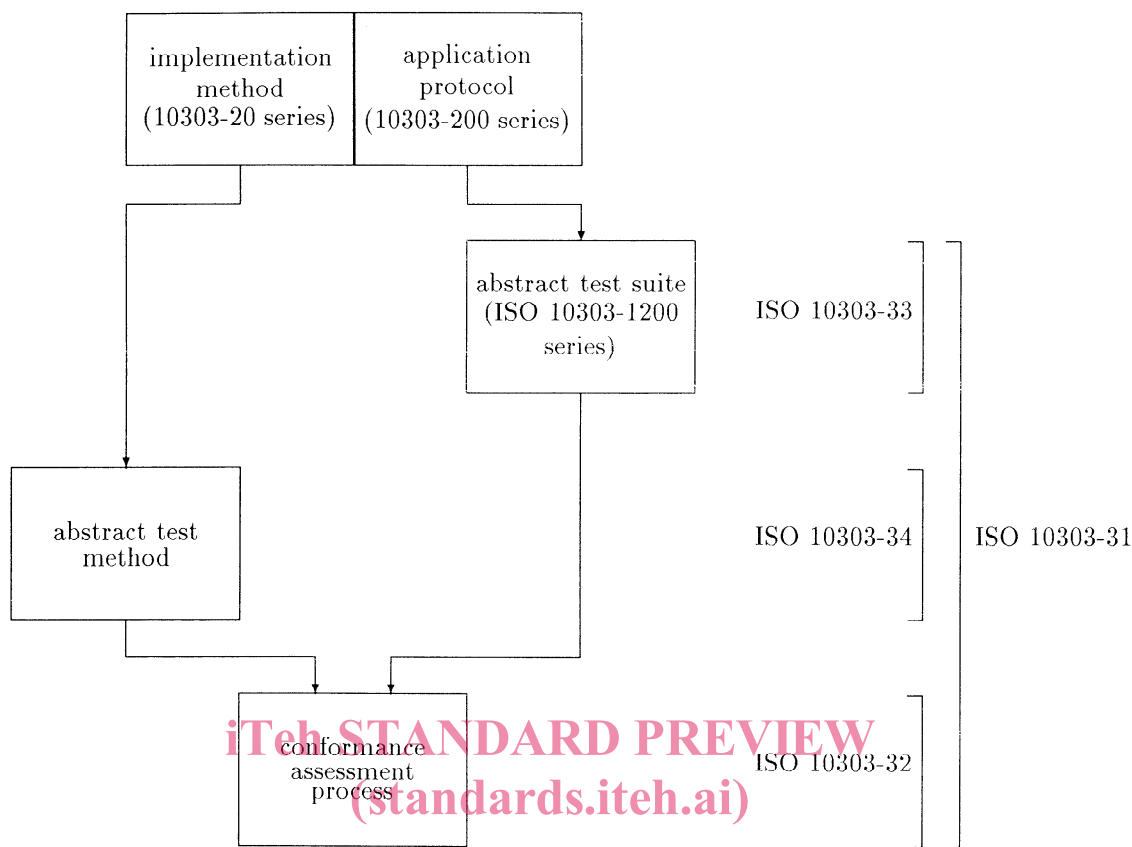


Figure 1 – Relationship between conformance testing standards and other series of parts

- a) to achieve an adequate level of confidence in the tests as a measure of conformance;
- b) to achieve comparability between the results of the corresponding tests applied in different places at different times;
- c) to facilitate communication between the parties responsible for the activities described in (a) and (b).

Requirements for procurement and contracts are outside the scope of this series of parts.

Testing by means of test methods which are specific to particular applications or systems is outside the scope of this series of parts.

The framework established by this part of ISO 10303 includes the concept of executable test suites. These, by their very nature, cannot be standardised; consequently, standardisation of executable test suites is outside the scope of this series of parts.

1.4 Coverage of this part of ISO 10303

This part of ISO 10303 provides introductory material, which is expanded further in the remaining parts of this series of parts of ISO 10303, including:

- a) an exposition of the meaning of conformance in the context of ISO 10303;
- b) a description of basic and capability tests;
- c) an introduction to the conformance assessment process;
- d) an introduction to the abstract test methods and their applicability;
- e) an introduction to the concepts of abstract test suite design.

The procedures required for testing the conformance of an implementation of ISO 10303 are outside the scope of this part of ISO 10303, but are addressed in ISO 10303-34.

The following types of testing are all outside the scope of this part of ISO 10303.

(user) acceptance testing: the process of determining whether an implementation satisfies acceptance criteria and enables the user to determine whether to accept the system. This includes the planning and execution of several kinds of tests (e.g., functional, volume, performance tests) to demonstrate the implemented software satisfies the user requirements.

interoperability testing: related to acceptance testing, but applied to the examination of the information exchange and sharing between two specific IUTs and the ability of each IUT to use such information.

performance testing: measures the performance characteristics of an IUT, such as its throughput, response time, number of transactions, and responsiveness under various conditions.

robustness testing: the process of determining how well an IUT processes data which contains errors.

This part of ISO 10303 provides a framework for certification (an administrative procedure which may follow conformance testing) in annex D. However, there is no ISO requirement for an implementation of ISO 10303 to undergo certification or conformance testing.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10303. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10303 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 8824-1:—¹⁾, *Information technology – Open Systems Interconnection – Abstract Syntax Notation One (ASN.1) – Part 1: Specification of Basic Notation.*

ISO 10303-1:1994, *Industrial automation systems and integration – Product data representation and exchange – Part 1: Overview and fundamental principles.*

ISO 10303-32:—¹⁾, *Industrial automation systems and integration – Product data representation and exchange – Part 32: Conformance testing methodology and framework: Requirements on testing laboratories and clients.*

3 Definitions

3.1 Terms defined in ISO 10303-1

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

- abstract test suite;
- exchange structure;
- implementation method;
- PICS proforma;
- Protocol Implementation Conformance Statement (PICS).

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3.2 Other definitions

For the purposes of this part of ISO 10303, the following definitions apply.

3.2.1 abstract test case (ATC): a specification, encapsulating at least one test purpose, that provides the formal basis from which executable test cases are derived. It is independent of both the implementation and the values.

3.2.2 abstract test group: a named set of related abstract test cases.

3.2.3 abstract test method: the description of how an implementation is to be tested, given at the appropriate level of abstraction to make the description independent of any particular implementation of testing tools or procedures, but with sufficient detail to enable these tools and procedures to be produced.

3.2.4 (laboratory) accreditation: the formalised initial and continuing process of ensuring a testing laboratory is competent to carry out specific (types of) tests.

¹⁾To be published.

NOTE – The term “laboratory accreditation” covers the recognition of both the technical competence and the impartiality of a testing laboratory. Accreditation is normally awarded following successful laboratory assessment and is followed by appropriate surveillance.

3.2.5 accreditation body: a body that conducts and administers laboratory accreditation and grants accreditation.

3.2.6 assessor: an expert selected to conduct assessment during accreditation of a particular laboratory.

3.2.7 attestation of conformity: action by a third-party testing laboratory, demonstrating that the specific IUT tested is in conformity with a specific standard or other normative document.

NOTE – Compare with *declaration of conformity* and *certification of conformity*.

3.2.8 basic tests: limited tests performed to determine whether it is appropriate to perform thorough testing.

3.2.9 capabilities of an IUT: the set of functions and options in the relevant standard that is supported by the IUT.

3.2.10 capability tests: tests performed to determine the capabilities of an IUT, designed to determine whether an implementation conforms to a particular feature of an application protocol as described in the test purpose.

3.2.11 certificate of conformance: see *certificate of conformity*.

3.2.12 certificate of conformity; certificate of conformance: a document issued under the rules of a certification system indicating that adequate confidence is provided that an IUT is in conformity with a specific standard or technical specification as determined through use of a specified test method.

3.2.13 certification body: an impartial body possessing the necessary competence and reliability to operate a certification system, and in which the interests of all parties concerned with the function of the system are represented.

NOTE – The certification body may decentralise its activities and rights to certify conformity.

3.2.14 certification mark: the certification body’s sign, symbol, or letter that identifies a product(s) or service(s) as being certified.

3.2.15 certification of conformity: action by a third party, demonstrating that adequate confidence is provided that an identified IUT is in conformity with a specific standard or other normative document.

NOTE – Compare with *declaration of conformity* and *attestation of conformity*.