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

Part 31:
Conformance testing methodology and framework: General concepts

Systèmes d'automatisation industrielle et intégration — Représentation et échange de données de produits —

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

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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.

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.

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:

a) the definition of abstract test suites for ISO 10303 application protocols;

b) the definition of abstract test methods for ISO 10303 implementation methods;

c) 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:

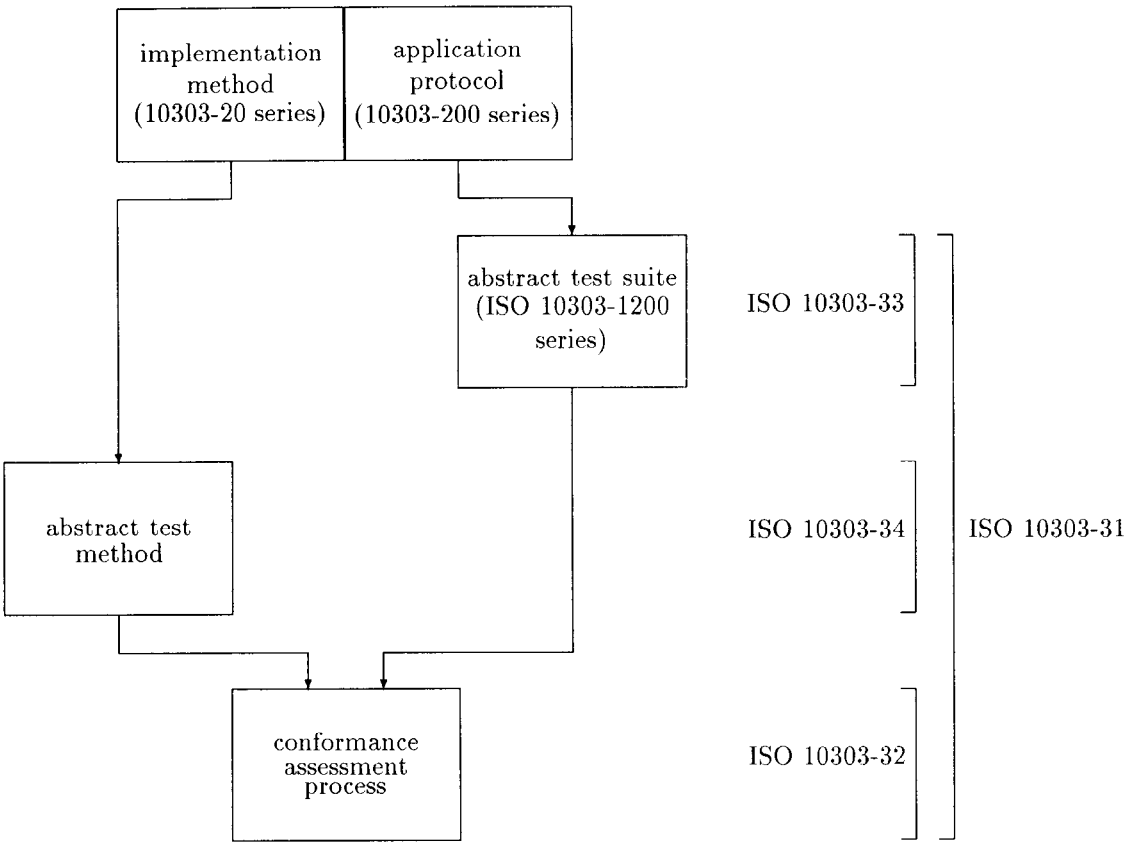

Figure 1 – Relationship between conformance testing standards and other series of parts

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).

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.*

3.2.16 certification system: a procedural and managerial system for carrying out certification of conformity that is overseen by a certification body.

NOTE – Certification systems may be operated at the national, regional or international level.

3.2.17 client (of a testing laboratory): the organisation that submits an implementation for conformance testing.

3.2.18 comparability (of results): characteristic of conformance assessment processes such that execution on the same SUT, in different testing laboratories, leads to the same overall summary.

3.2.19 conformance: see *conformity.*

3.2.20 conformance assessment process: the process of accomplishing the conformance testing activities necessary to determine the conformance of an implementation to an application protocol.

3.2.21 conformance log: a record of information, produced as a result of a test campaign, that is sufficient to make and verify the assignment of test verdicts.

3.2.22 conformance testing: 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.

3.2.23 (conformance) test report: a document written at the end of the conformance assessment process, that provides the overall summary of the conformance of the IUT to the standard for which conformance testing was carried out, and that gives the details of the testing.

3.2.24 conforming implementation: an implementation which satisfies the conformance requirements, consistent with the capabilities stated in the PICS.

3.2.25 conformity; conformance: the fulfilment by an implementation of all requirements specified.

3.2.26 control board: an impartial body possessing the necessary competence and reliability to approve and maintain proficient test suites for the testing programme, and in which the interests of all parties concerned with the function of the tests are represented.

3.2.27 declaration of conformance: see *declaration of conformity.*

3.2.28 declaration of conformity; (manufacturer's) declaration of conformance: a statement by a supplier claiming under his sole responsibility that an IUT is in conformity with a specific standard or other normative document.

NOTES

1 – Compare with *attestation of conformity* and *certification of conformity.*

2 – The term "self certification" should not be used, in order to avoid any confusion with the concept of certification which should imply the involvement of a third party.

3.2.29 executable test case: an instantiation of an abstract test case with values. 8: 3.6.4] (SG4: 19th January 1989)

3.2.30 executable test suite: the set of executable test cases necessary to perform conformance testing of an implementation against a standard or group of standards.

3.2.31 fail (verdict): a test verdict given when the observed test outcome demonstrates non-conformance with respect to either the test purpose or at least one of the conformance requirements in the relevant standard(s).

3.2.32 falsification testing: a test method developed to find errors in the implementation. If errors are found, one can correctly deduce the implementation does not conform to the standard; however, the absence of errors does not necessarily imply the converse. Falsification testing can only demonstrate non-conformance.

NOTE – Compare with *verification testing.*

3.2.33 Implementation Under Test (IUT): that part of a product which is to be studied under testing, which should be an implementation of one or more characteristics of the standard(s) based on a given implementation method.

3.2.34 inconclusive (verdict): a test verdict given when the observed test outcome is such that neither a pass nor a fail verdict can be given.

3.2.35 in-house testing: the testing undertaken by the client (of a testing laboratory) using the executable test suite supplied by the testing laboratory prior to submission for the formal phase of the service.

3.2.36 manufacturer's declaration of conformance: see *declaration of conformity.*

3.2.37 non-conformance: see *non-conformity.*

3.2.38 non-conformity; non-conformance: the failure of an implementation to fulfil one or more requirements specified.

3.2.39 pass (verdict): a test verdict given when the observed test outcome gives evidence of conformance to the conformance requirement on which the test purpose is focused and is valid with respect to the relevant standard(s) and with respect to the PICS.

3.2.40 PIXIT proforma: a document, in the form of a questionnaire, written and provided by the testing laboratory which, when completed during the preparation for testing, becomes the PIXIT.

3.2.41 postprocessor: a software unit that translates product information from an independent public domain product data format to the internal format of a particular computer system.

3.2.42 preprocessor: a software unit that translates product information from the internal format of a particular computer system to an independent public domain product data format.

3.2.43 proficiency testing: determination of laboratory testing performance by means of inter-laboratory test comparisons or by testing systems for which the results have already been determined.

NOTE – This does not form part of conformance testing: see D.3.5.4.

3.2.44 Protocol Implementation eXtra Information for Testing (PIXIT): a statement made by the client which contains or references all of the information (in addition to that given in the PICS) related to the IUT and its corresponding SUT, which will enable the testing laboratory to run an appropriate test suite against that IUT.

3.2.45 repeatability (of results): characteristic of an abstract test case and derived executable test case(s), such that repeated executions on the same SUT under the same conditions lead to the same test verdict; and, by extension, a characteristic of an abstract test suite and derived executable test suite(s).

3.2.46 resolution tests: tests performed to determine in depth whether or not an implementation satisfies specific requirements.

3.2.47 selected abstract test suite: the set of abstract test cases selected using a specific PICS.

3.2.48 selected executable test suite: the set of executable test cases selected using a specific PICS.

3.2.49 System Under Test (SUT): the computer hardware, software and communication network required to support the IUT.

3.2.50 test campaign: the process of running the executable test suite for a particular IUT.

3.2.51 test case: use of this term is deprecated: see *Abstract Test Case* or *Executable Test Case*.

3.2.52 test case error: a statement made with respect to an abstract test case when an error is detected in the abstract test case itself or its executable equivalent.

3.2.53 test purpose: a precise description of an objective which an abstract test case is designed to achieve.

3.2.54 test realiser: an organisation which takes responsibility for providing, in a form independent of the clients of a testing laboratory and their IUTs, a means of testing IUTs.

3.2.55 test report: see *conformance test report.*

3.2.56 test verdict: see *verdict.*

3.2.57 testing laboratory: an organisation that carries out the conformance assessment process.

NOTE – A testing laboratory can be a third party, a user organisation, an administrative organisation, or an identifiable part of a supplier organisation.

3.2.58 (test) verdict: a statement of "pass", "fail", or "inconclusive" concerning conformance of an IUT with respect to an executable test case and the abstract test case from which it was derived.

3.2.59 verdict criteria: information defined within an abstract test case which enables the testing laboratory to assign a verdict.

3.2.60 verification testing: the process of proving mathematically whether an IUT is correct, consistent and complete.

NOTE – Compare with *falsification testing.*

4 Abbreviations

For the purposes of this series of parts the following abbreviations apply.

ATC	Abstract Test Case
CTR	Conformance Test Report
IUT	Implementation Under Test
PICS	Protocol Implementation Conformance Statement
PIXIT	Protocol Implementation eXtra Information for Testing
SUT	System Under Test

5 Conformance

5.1 The meaning of conformance in ISO 10303

In the context of ISO 10303, an implementation exhibits conformance if it complies with the conformance requirements of the applicable part(s) of ISO 10303.

Conformance of an implementation is expressed either as conformance to an application protocol combined with an implementation method or as conformance to a description method. Conformance of an implementation shall be determined by using an executable test suite generated from the applicable standard abstract test suite. Each abstract test suite is documented in the ISO 10303-1200 series of parts and is referenced normatively by the corresponding application protocol.

5.2 Conformance requirements

The conformance requirements in a standard can be:

a) mandatory requirements: these are to be observed in all cases;

b) conditional requirements: these are to be observed if certain conditions set out in the standard apply;

c) optional requirements: these can be selected to suit the implementation, provided that any requirements applicable to the option are observed.

NOTE – More information on options is provided in annex B.

Furthermore, conformance requirements in a standard can be stated:

a) positively: they state what shall be done;

b) negatively (prohibitions): they state what shall not be done.

5.3 Protocol Implementation Conformance Statement

To evaluate the conformance of a particular implementation, it is necessary to have a statement of the options which have been implemented so that the implementation can be tested for conformance against relevant requirements, and against those requirements only. Such a statement is called a Protocol Implementation Conformance Statement (PICS). The options within the PICS shall only be stated within the framework of requirements specified in the relevant parts of ISO 10303. The PICS shall not include options beyond this framework.

The PICS is used by the testing laboratory to have a better understanding of the SUT for the conformance assessment process and to help to identify the boundaries of the domain of testing.

NOTE – In order to evaluate two or more systems for successful interoperability, it is recommended that a comparison be made of the PICSs of these systems, comparing each option to determine if both systems claim to support it. If the systems use different versions of the relevant standard, as indicated in the PICSs, the differences between the versions need to be identified and their implications for interoperability need to be considered, including their use in combination with other standards.

The PICS is generated by the client using a PICS proforma. The PICS proforma is a standardised document included in the relevant part of ISO 10303. It is a questionnaire used as a framework by the client to document those SUT capabilities necessary to undertake conformance testing.

A PICS is needed for each International Standard providing a PICS proforma that has been implemented in a system.

5.4 A conforming system

A conforming system or implementation is one which satisfies the conformance requirements of the implemented part of ISO 10303, consistent with the PICS. Such an implementation shall have passed all tests constituting the domain of testing, including any optional requirements stated as supported in the PICS.

Use of the term 'conformity' is ambiguous unless used with the identification of both implementation method, the application protocol, and (where appropriate) the conformance class.

6 Conformance testing

6.1 Introduction

This clause introduces two enabling technologies of the conformance assessment process: the different types of conformance tests used and the PIXIT. It also describes the phases and properties of the conformance assessment process.

6.2 Types of conformance tests

In principle, the objective of conformance testing is to establish whether the implementation being tested conforms to the requirements stated in the relevant application protocol. This series of parts distinguishes two types of tests, according to the extent to which they provide an indication of conformance.

a) Basic tests, which provide preliminary evidence that an IUT conforms. It is optional to specify these tests in the abstract test suite; however, if the standard abstract test suite identifies tests to be used as basic tests, they shall be used at the start of the conformance assessment process. Such tests are standardised.

b) Capability tests, which check that the observable capabilities of the IUT are in accordance with the capabilities claimed in the PICS. They endeavour to provide testing which

is as comprehensive as possible over the full range of conformance requirements as specified by the standard. Such tests are standardised.

NOTE – Resolution tests probe in depth whether an IUT satisfies a particular requirement and provide a definite yes or no answer and diagnostic information in relation to specific issues. Such tests are not standardised. More details are given in annex C.

A standard abstract test suite shall include a list of which capability tests, if any, shall be used as basic tests. A standard abstract test suite does not include any basic tests that are additional to the set of capability tests.

6.2.1 Basic tests

Basic tests provide limited testing of an IUT to establish that it is appropriate to perform thorough testing. They may be in abstract or executable form and are used to determine if there is sufficient conformance before doing thorough testing. They may also be used during the preparations for testing. They are the first tests to be performed during the test campaign. Basic tests are not fundamentally different from capability tests, they are simply less complex.

The use of basic tests is appropriate:

a) for detecting obvious cases of non-conformance;

EXAMPLE 1 – software failure;

b) as a preliminary step in order to decide whether or not to run capability tests;

c) for use by users of implementations, to determine whether the implementations appear to be usable for communication with other conforming implementations;

EXAMPLE 2 – as a preliminary to data interchange.

The use of basic tests (without capability tests) is inappropriate to:

a) determine whether an implementation conforms;

b) guarantee the determination of causes for failure of interoperability.

6.2.2 Capability tests

Capability tests, which may be in abstract or executable form, exercise an implementation as thoroughly as is practical over the full range of conformance requirements specified in a standard. This involves checking all mandatory capabilities and those optional ones that are stated in the PICS as being supported by the IUT (see annex B).

The use of capability tests is appropriate to:

a) check that the capabilities of the IUT are consistent with the conformance requirements;

b) determine whether or not an implementation conforms;

c) investigate causes for failure of interoperability.

The use of capability tests is inappropriate to:

a) test in detail the behaviour associated with each capability which has been implemented;

b) guarantee interoperability.

Abstract capability tests are standardised within an abstract test suite.

6.3 Protocol Implementation eXtra Information for Testing

In order to test an implementation, the testing laboratory requires information relating to the IUT and the environment in which it will be tested, in addition to that provided by the PICS. This Protocol Implementation eXtra Information for Testing (PIXIT) shall be provided by the client submitting the implementation for testing, as a result of completing the question/answer process initiated by the PIXIT proforma.

The PIXIT may contain the following:

a) information about the IUT which is needed by the testing laboratory in order to be able to run the appropriate executable test suite against that IUT and analyse the results;

b) reference to the related PICS and any other administrative information.

Further details on the PIXIT are given in ISO 10303-32.

The PIXIT shall not conflict with the related PICS; a consistency check is performed during preparation for testing to remove any inconsistencies. While the PICS gives information to the testing laboratory for the definition of the domain of testing, the PIXIT gives information on how to perform the testing. In particular, it provides the details on the organisation and storage of concepts in the SUT and on the means of access to and modification of the SUT. It also contains conversion algorithms between concepts of the IUT and the standard. There is one PIXIT for each conformance assessment process.

NOTE - Further information to assist interoperability between two systems can be obtained by extending the PICS evaluation (see 5.3) to other relevant information, including conformance test reports and PIXITs.

6.4 Conformance assessment process overview

The conformance assessment process encompasses all conformance testing activities necessary to determine the conformance of an implementation to the relevant parts of ISO 10303.

The conformance assessment process involves four phases:

a) preparation for testing;

b) test campaign;

c) analysis of results;

d) conformance test report production.

NOTE – The overview of the conformance assessment process is illustrated in figure 2.

The requirements to be met by the testing laboratory and its client during the conformance assessment process are specified in ISO 10303-32.

6.5 Preparation for testing

The preparation for testing phase involves:

a) production of administrative information;

b) production of PICS and PIXIT;

c) identification of abstract test method (for the IUT's implementation method) and abstract test suite;

d) a PICS review, conducted by analysing the PICS with respect to the relevant conformance requirements;

e) a PIXIT review which includes a consistency check against the PICS;

f) initial abstract test case selection and assignment of parameter values based on the PICS and PIXIT;

g) preparation of the SUT;

NOTE 1 – This enables a client to run executable test cases on the IUT before presenting the IUT for the test campaign.

h) final abstract test case selection and assignment of parameter values based on the PICS and PIXIT.

An executable test suite is produced as a result of abstract test case selection and the assignment of parameter values (steps f and h above); it comprises basic tests (optional) and capability tests.

At this point, the IUT and the scope of the conformance assessment process are fixed and cannot be changed subsequently. This is achieved by agreement between the client and the testing laboratory.

NOTE 2 – Further details are given in ISO 10303-32.

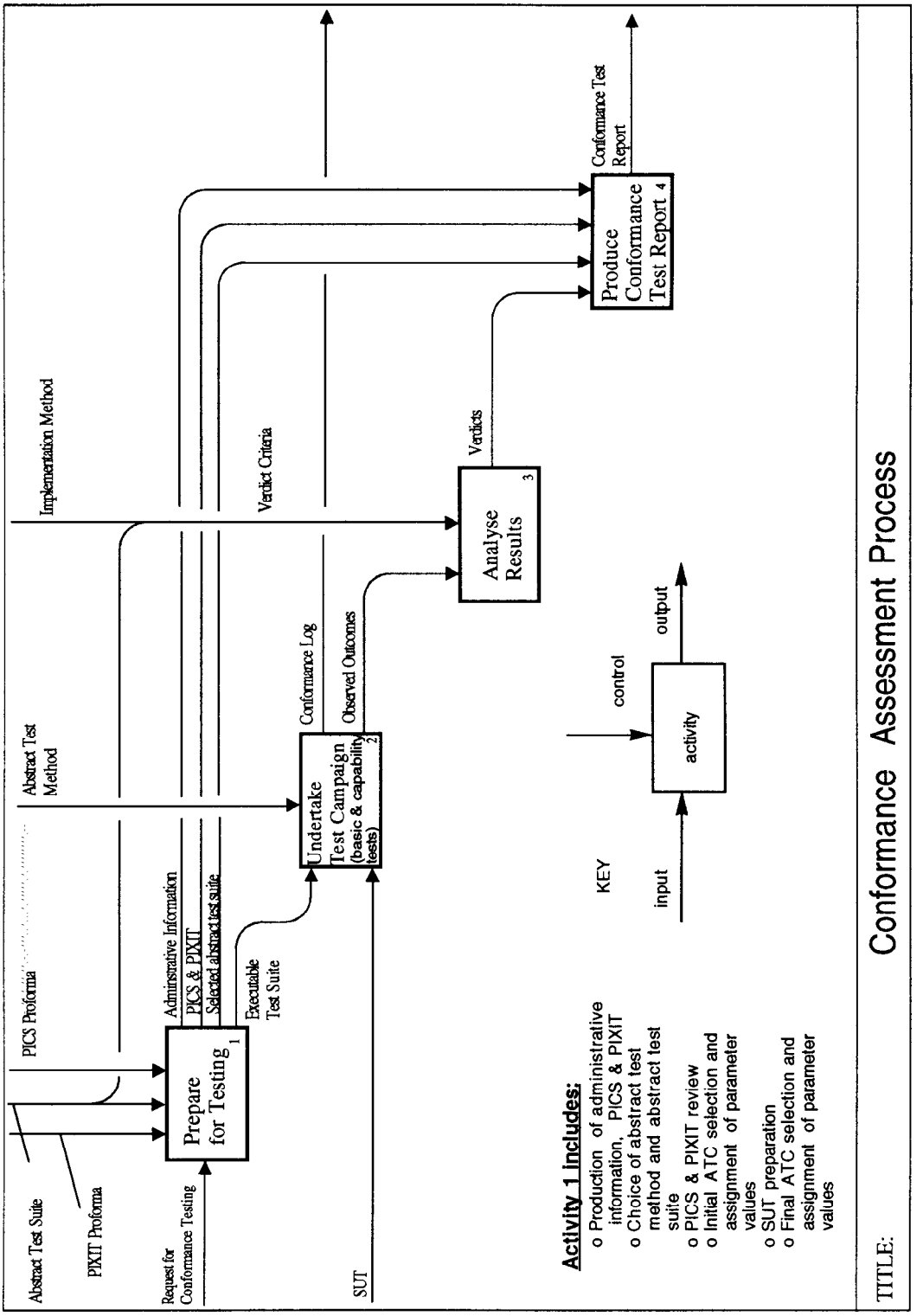

Figure 2 – Overview of the conformance assessment process

6.6 Test campaign

A test campaign is the process of running the executable test suite and recording the observed test outcome and any other relevant information in a conformance log. The input to the IUT and the observed test outcome resulting from the execution of a test case shall be recorded in the conformance log. The recording and retention of all information provided by the IUT during the test campaign is necessary for the analysis phase and for auditing purposes.

6.7 Analysis of results

The analysis of results is performed by evaluating the observed test outcome against the verdict criteria which are prescribed by the abstract test case. Although there is a clear distinction between the test campaign and the analysis phase, the two may overlap in time.

NOTE – The means by which this evaluation is made is outside the scope of this part but is addressed in ISO 10303-34.

A test verdict is a statement of **pass**, **fail**, or **inconclusive**. Pass and fail are the two major verdicts but in rare cases a verdict of inconclusive may have to be assigned. A justification shall be given with each fail or inconclusive verdict; informative messages may also be provided.

a) **pass** means that the observed test outcome gives evidence of conformance to the conformance requirement on which the test purpose is focused, and is valid with respect to the relevant standard and with respect to the PICS.

b) **fail** means that the observed test outcome demonstrates non-conformance with respect to either a test purpose or at least one conformance requirement in the relevant standard(s).

EXAMPLE 3 – abnormal termination - if the execution of the executable test case is terminated prematurely, for whatever reason.

c) **inconclusive** means that the observed test outcome is such that neither a pass nor a fail verdict can be given. This should be given only in very rare circumstances.

EXAMPLE 4 – test case error.

The verdict shall be assigned to a particular test outcome using the verdict criteria relevant to that particular abstract test case.

The verdicts assigned shall then be synthesised into an overall summary for the IUT.

6.8 Conformance test report production

The results of conformance testing shall be documented in a conformance test report. This report shall be in two parts: a summary and detailed information. A proforma for each part is given in ISO 10303-32, and shall be used to produce each conformance test report.

The first part gives an overall summary of the conformance status of the IUT. This overall summary gives an overview of the verdicts that are assigned to the test cases executed in the conformance assessment process. The second part documents all of the results of running the

executable test cases, giving references to the conformance log which contains the observed test outcomes. It also gives reference to all necessary documents relating to the conduct of the conformance assessment process for that standard.

NOTE – ISO 10303-32 provides suggested wording for the inclusion in conformance test reports of an appropriate warning, stating the limits of conformance testing with respect to interoperability.

6.9 Intrinsic properties of the conformance assessment process

The conformance assessment process shall ensure that the results acquired are repeatable, comparable, and auditable.

6.9.1 Repeatability of results

To achieve the objective of credible conformance testing, the result of executing an executable test case on a given SUT should be the same whenever it is performed. It should be possible to execute a complete executable test suite and observe test outcomes which are identical to those obtained on another occasion.

6.9.2 Comparability of results

In order to achieve the objectives of conformance testing, the overall summary concerning conformance of an IUT has to be independent of the testing laboratory in which the testing takes place. That is to say, the standardisation of all the procedures concerned with conformance testing should result in a comparable overall summary being accorded to the IUT, whether the testing is done by a supplier (first party), a user (second party), or by any (third party) testing laboratory.

NOTE – The different types of testing laboratory are defined in [6].

There are important factors to be considered to achieve this, of which some are:

a) careful design and unambiguous specification of the abstract test cases to show which conformance requirements have to be met and how the verdicts are to be assigned while allowing flexibility where appropriate;

b) careful specification of the procedures to be followed by testing laboratories when it is necesary to repeat the execution of a test case;

c) a proforma for a conformance test report;

d) careful specification of the procedures for writing a conformance test report.

6.9.3 Auditability of results

It may be necessary to review the observed test outcomes from the execution of a test suite in order to make sure that all procedures have been correctly followed. Whether or not analysis

of results is carried out manually or automatically, it is essential that all inputs and outputs are logged for each test case being executed. It is the responsibility of the testing laboratory to produce the conformance log for each test campaign, so that it can be used for future reference.

7 Abstract test methods

Implementations of application protocols may choose any of the implementation methods specified by ISO 10303, subject to requirements specified in the application protocol. The requirements for each implementation method are specified in the 20-series of parts, devoted to this area. This means that there is variation in the ways in which such implementations can be controlled and observed during the conformance assessment process. An abstract test method is required for each implementation method. In practice, some aspects of the abstract test methods are common to all implementation methods.

8 Abstract and executable test suites

8.1 Structure

Abstract test suites have an hierarchical structure in which the lowest level is the abstract test case.

NOTE – This structure is shown in figure 3.

Each abstract test case exercises at least one test purpose from the appropriate standard.

Within an abstract test suite, nested abstract test groups may be used to provide a logical ordering of the abstract test cases. Abstract test groups may be nested to any depth. They may be used to aid planning, development, or understanding of the abstract test suite. Each abstract test group is composed of zero, one, or many abstract test cases.

An executable test suite is a collection of executable test cases.

8.2 Test purposes

All test purposes are documented in the abstract test suite corresponding to the application protocol. Each gives a precise description of the objective which an abstract test case is then designed to achieve.

EXAMPLE 5 – 'test the generation of a curve as a composite curve with senses undefined'.

8.3 Abstract test cases

An abstract test case is written to satisfy the requirement(s) of one or more test purpose(s) as specified in ISO 10303-33. An abstract test case is used as the basis for generating an executable test case and is independent of the IUT.

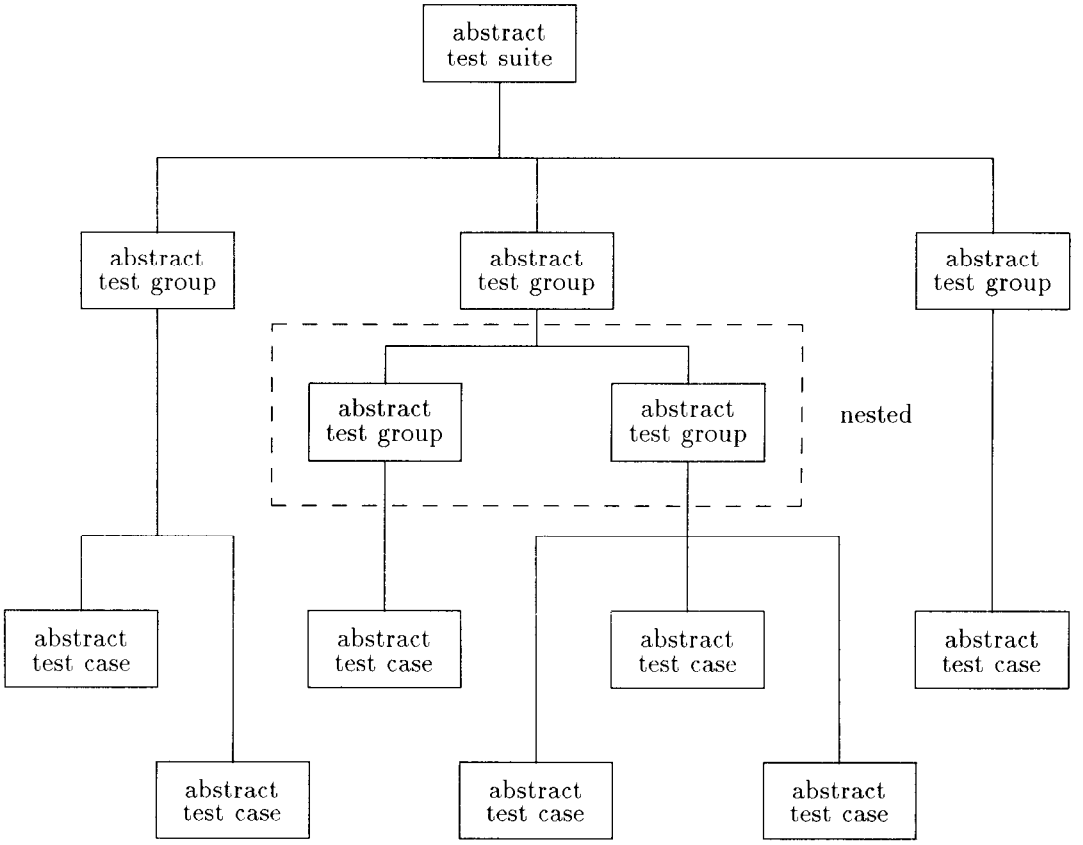

Figure 3 – Example structure of an abstract test suite

An abstract test case shall contain:

- test purpose(s);
- test case identifier;
- reference to specific parts of the standard(s);
- verdict criteria.

An abstract test case may contain:

- formal language definitions of the model to exercise the test purpose(s);
- statements indicating the construction sequence for the model.

8.4 Executable test cases

An executable test case shall contain:

- test purpose(s);
- test case identifier;
- reference to specific sections of the standard(s);
- verdict criteria;
- model with values required to exercise the test purpose(s).

It may contain:

- an exchange structure;
- a pictorial representation of the model.

8.5 Relationship between abstract and executable test cases

An executable test case is derived from an abstract test case and is in a form which allows it to be run on the IUT. This derivation includes the assignment of parameter values, of which there are potentially many for each abstract test case, and written instructions.

The core of the executable test case results from the instantiation with values of an abstract test case. It is either implementation dependent or neutral format dependent.

Because the executable test case is dependent upon the SUT and the assignment of parameter values, it cannot be standardised.

The procedure to derive an executable test case from an abstract test case is presented in ISO 10303-33.

Annex A
(normative)
Information object registration

In order to provide for unambiguous identification of an information object in an open system, the object identifier

{ iso standard 10303 part(31) version(1) }

is assigned to this part of ISO 10303. The meaning of this value is defined in ISO 8824-1, and is described in ISO 10303-1.

Annex B
(informative)
Optional conformance requirements

This annex provides examples of types of optional conformance requirements (see 5.2).

Options are those items in an International Standard for which an implementor may choose the item to suit the implementation.

Such a choice is not always truly free. There may be requirements which specify the conditions under which the option applies and the limitations of the choice.

Conversely, there may be mandatory or conditional requirements, or prohibitions, in a standard which are dependent on the choice made or on a combination of the choices already made.

The following are examples of options and associated requirements; the list is not exhaustive.

a) 'Boolean' options: the option is 'do or do not do'; the requirement is 'if do, then do as specified'.

b) Mutually exclusive options: the option is to do any one of n actions; the requirement is to do exactly one of them.

c) Selectable options: the option is to do any m out of n actions; a requirement is to do at least one action ($1 \leq n$ and $n \geq 2$).

Annex C
(informative)
Resolution tests

Resolution tests provide diagnostic answers, as near to definitive as possible, to the resolution of whether an implementation satisfies particular requirements. Because of the problems of exhaustiveness noted in the Introduction and in 6.2, the definitive answers are gained at the expense of confining tests to a narrow field. They do not form part of a test campaign and hence do not appear in the conformance test report.

Resolution tests are not standardised.

The test method will normally be chosen specifically for the requirements to be tested, and need not be one that is generally useful for other requirements. There may even be test methods that are regarded as being unacceptable for standard abstract test suites, e.g., involving implementation-specific methods that use the diagnostic and debugging facilities of the specific system.

In particular, resolution tests may include SUT-specific means in order to test aspects of the standard which are outside the scope of standard conformance tests.

Resolution tests are appropriate:

a) for providing a yes or no answer in a strictly confined and previously identified situation (e.g., during implementation development, to check whether a particular feature has been correctly implemented, or during operational use, to investigate the cause of problems);

b) as a means of identifying and offering resolutions for deficiencies in a current conformance test suite.

Resolution tests, in isolation, are inappropriate as a basis for judging whether or not an implementation conforms.

Resolution tests are most likely to be undertaken:

a) following the conformance assessment process, in order to provide more detailed diagnosis to a problem which arose during it;

b) to provide an answer concerning a particular combination of options of interest to a user.

Annex D
(informative)
Supporting organisations

D.1 Introduction

D.1.1 Purpose

The purpose of this annex is to promote the integrity of national conformance testing programmes for ISO 10303 and encourage international harmonisation; it extends the normative conformance testing documents to include:

- guidance on establishing national conformance testing organisations;
- coordination of international organisations' activities, their roles and responsibilities;
- testing laboratory accreditation procedures;
- administrative procedures to carry out a conformance testing service which may ultimately culminate in a certificate of conformity being issued.

This informative annex provides recommended practices for establishing authorities and procedures for instituting a conformance testing service. It also covers the optional practice of issuing a certificate of conformity for conforming products, based on the conformance test report.

There are normative parts of this International Standard which address some aspects of the procedures specified here. If there is conflict between any normative part of this International Standard and this annex, the normative part takes precedence.

D.1.2 Scope

This annex applies to all conformance testing services associated with the standards within the scope of ISO TC184/SC4.

D.1.3 Intended readership

This annex is aimed at national and international standardisation bodies interested in fostering harmonisation between conformance testing services for any given standard:

- certification bodies;
- accreditation bodies;
- testing laboratories;
- users of these services.

D.1.4 Background

This annex provides procedures to encourage cooperation by national and international certification and standardisation bodies to set up a common strategy for certification; these institutions should enforce mutual recognition of testing results and certificates of conformity for implementations of ISO 10303. The scope of harmonisation activities ranges from the bilateral recognition of the testing laboratories (e.g., memoranda of understanding) involved in the conformance testing services up to the approval of standardised test procedures by the standardisation bodies. [2)]

D.1.5 General philosophy of conformance testing

National and international standards are needed to preserve open competition in international markets and to support increased productivity and delivery of services at reduced cost. Through standards, users are provided with commercial hardware, software and communications products for computer and related telecommunications systems. Conformance testing of those computer products claiming conformance with standards further reduces risks and uncertainties to vendors and users. Uniform procedures should be employed to perform this conformance testing.

D.2 Responsible authorities

Figure D.1 provides a perspective of the various authorities, both national and international, which are involved in conformance testing. A certificate of conformity may optionally be issued by the certification body, after the conformance assessment process.

More than one function may be performed by a single organisation; for example, the duties of both the certification body and the accreditation body may be undertaken by a single enterprise.

D.2.1 Control board

D.2.1.1 General recommendations

A control board should be established for the purpose of:

a) resolving differences between interpretations which arise when the test suite is being used for the purpose of conformance testing;

b) handling queries on the test suite;

c) ensuring resolution of technical problems identified in the standards;

d) arbitrating disputes between testing laboratories and their clients.

[2)] There is an international Memorandum of Understanding between France, Germany, the United Kingdom, and Sweden for the development of harmonised abstract test suites and test tools. Ultimately their goal is a harmonised conformance testing service in response to the European Community economic goal as prescribed in CEN/CENELEC Memorandum M-IT-03 on Specification of Information Technology Products, CEN/CENELEC, March, 1985.

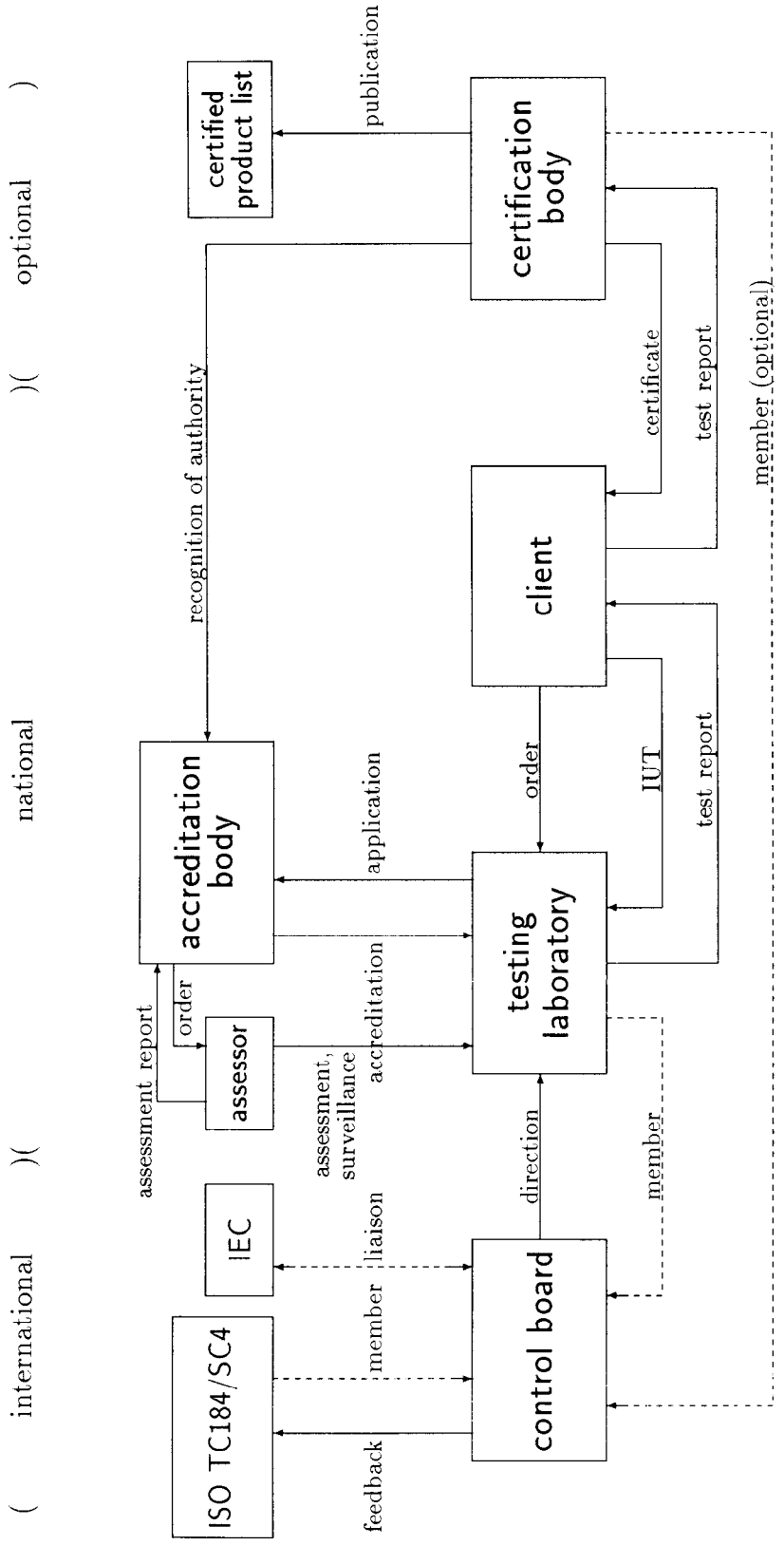

Figure D.1 – Infrastructure for conformance testing

Problems and decisions should be forwarded to ISO TC184/SC4. The control board should include one representative from each testing laboratory and at least two representatives from ISO TC184/SC4. The control board may include one representative from each certification body. Representatives are encouraged to have a combination of technical expertise in the standards, as well as enough management authority to make decisions on behalf of their respective organisation. The control board should be independent of ISO TC184/SC4.

A secretariat for the control board should be set up. A file of all queries and rulings should be kept by the secretariat.

Control board rulings should be strictly adhered to by certification bodies and their delegated representatives.

D.2.1.2 Responsibilities

The control board should:

– assist testing laboratories in interpreting the required technical content of a standard abstract test suite;

– establish voting procedures to determine the inadequacies of an abstract test case or abstract test suite for a given version of the standard;

– inform testing laboratories on the withdrawal of abstract test cases or abstract test suites that are deemed to be faulty and inform testing laboratories of subsequent correction of the abstract test cases or abstract test suites. If an abstract test case is withdrawn then it is withdrawn from the current version of the abstract test suite only. It may be corrected and included in a subsequent version. A list of withdrawn abstract test cases should be kept and this list should be included in each test report;

– resolve client disputes concerning interpretation of the test results by a testing laboratory. Queries from a client should be sent by the testing laboratory to the control board secretariat, who forwards them to all members of the control board. The control board should provide a ruling on the query to the secretariat, who forwards this to the testing laboratory who then informs the client. In all cases, the client should receive a decision on this query as soon as possible after its receipt by the secretariat;

– provide decisions, in conjunction with ISO TC184/SC4, on disputes concerning interpretation of the standard;

– establish and maintain liaison with ISO TC184/SC4;

– maintain a record of control board decisions regarding the standard and published test results.

D.2.2 Accreditation body

D.2.2.1 General recommendations

The accreditation body should:

– comply with recognised national and international systems for laboratory accreditation to enhance the international acceptance of test reports;

– provide accreditation services to laboratories requesting accreditation;

– give national recognition for competent laboratories;

– provide laboratory management with a quality assurance check of the performance of their laboratories.

D.2.2.2 Responsibilities

The accreditation body should:

– determine accreditation criteria for testing laboratories: since technical requirements for laboratory accreditation are specific for each standard, requirements for accreditation should be developed using expert advice in that given field;

– identify and accredit competent laboratories;

– provide laboratories with guidance from technical experts to aid them in reaching a higher level of performance resulting in the generation of improved engineering and product information;

– keep records of all those testing laboratories recognised to undertake conformance testing, and for which standards they are qualified;

– notify the testing laboratory, control board, and certification body when the testing laboratory is no longer accredited.

An accreditation body may wish to delegate fully or partially the assessment of a testing laboratory to another competent body. Whilst it is acknowledged that this may be a practical solution to extending recognition of testing laboratories, it is essential that such assessment be equivalent to that applied by the accreditation body and that the accreditation body take full responsibility for such extended accreditation.

D.2.3 Testing laboratory

D.2.3.1 General requirements

General requirements for the testing laboratory are provided in ISO 10303-32.

D.2.3.2 Responsibilities

The testing laboratory should:

– carry out conformance testing and provide test reports to the client. In addition, provide test reports for the certification body upon the client's request;

– develop and maintain a contractual commitment to the accreditation body;

– optionally, develop and maintain a contractual commitment to any certification body;

– treat all test results and documents confidentially, except those which are explicitly stated as public, e.g., conformance test reports;

– comply with all requirements for accreditation;

– conform to existing laws. Accreditation does not relieve the laboratory of the need to observe and obey existing national, state, and local statutes, ordinances, or regulations that may be applicable to its operation, including consumer protection and anti-trust laws;

– accredited laboratories are encouraged, within specified limits, to publicise their accredited status. The major restriction is that advertising should not imply product certification by the certification body or national government. The testing laboratory should state the services and period for which accreditation has been granted. (Laboratories and their clients may use references of their accredited status in consumer media, in product advertising, or on product labels, containers, or packaging; these references should be dated.)

D.2.4 Certification body

D.2.4.1 General recommendations

The certification body should:

– comply with recognised national and international systems for laboratory accreditation to enhance the universal acceptance of certificates;

– ensure that the use of its services are not conditional upon membership in any association or group; nor that there are undue financial conditions to restrict participation;

– administer in a nondiscriminatory manner the procedures under which the body operates.

Each P-member of ISO TC184/SC4 should identify the membership and associated organisation(s) of their own national certification bodies.

D.2.4.2 Responsibilities

The certification body should:

- establish well defined criteria for issuing a certificate, including limits of liability;
- select testing laboratories;
- identify laboratories to those clients which request testing for conformity to a standard;
- collaborate with the testing laboratory(ies) in drafting a contract for conformance testing services to include national regulations which define rights and obligations in detail;
- issue certificates based upon the test report;
- notify the public at the national level by advertising new services when the technical requirements and test methods are developed for the standard. At a minimum, the advertisement should:

  a) identify the scope of the programme;

  b) advise how to request such services.

D.3 Administration and certification

D.3.1 Guidelines for role of the certification body

The certification body issues certificates, based upon well defined criteria. These criteria include meeting the requirements as defined in the application protocol, such as completeness of representation. A certification body should exist for each standard in each country which has a conformance testing service operating. Mutual recognition of test results is ensured by adoption of the same criteria by certification bodies worldwide.

D.3.2 Sponsoring a laboratory accreditation programme

The accreditation body should:

- ensure the testing laboratory is accessible to anyone, including foreign clients;
- establish any national criteria necessary for assessing competence of laboratories to perform testing. (Information contained in this document should assist in the generic aspects of assessment plan development.) On-site assessment can be carried out by an accreditation body;
- confirm that qualified technical experts and evaluators are used for accrediting a testing laboratory;

– ensure there are procedures for recommending the laboratory either be granted or denied accreditation. This recommendation is based on a review of the evaluation and other records to ensure that all technical, financial, and administrative obligations have been satisfied.

D.3.3 Conditions for testing laboratory accreditation

The conditions for a laboratory to become accredited and maintain accreditation depends on the testing requirements. Laboratory accreditation may require the testing laboratory to:

– be assessed and evaluated initially and on a periodic basis;

– demonstrate, on request, that it is able to perform the tests representative of those for which it is seeking accreditation;

– be capable of performing the tests for which it is accredited according to the agreed version of the test method;

– participate in proficiency testing as required; this may form part of the testing laboratory's periodic assessment;

– pay any relevant fees;

– limit the representation of the scope of its accreditation to only those tests or services for which accreditation is granted;

– limit advertising of its accredited status to letterheads, brochures, test reports, and professional, technical, trade, or other laboratory services publications;

– inform its clients that the laboratory's accreditation or any of its test reports in no way constitutes or implies product conformance, approval, or endorsement by the laboratory;

– maintain records of all actions taken in response to testing complaints for a minimum of one year (in practice, national accreditation may require this period to be longer);

– maintain an independent relationship between itself and its clients, affiliates, or other organisations so that the testing laboratory's capacity to render test reports objectively and without bias is not adversely affected;

– report to the accreditation body within thirty days any major change involving the location, ownership, management structure, authorised representation, approved signatories, or facilities of the laboratory.

D.3.4 Criteria for accrediting testing laboratories

The criteria which address a laboratory's quality system, staff, facilities and equipment, test methods and procedures, records, and test reports (documented in [7]) should be considered in order for a testing laboratory to be accredited.

D.3.5 Testing laboratory assessment

D.3.5.1 Testing laboratory application

A sample application for a testing laboratory to complete prior to on-site assessment is provided in [8].

In accepting an application from a foreign-based laboratory, consideration should be given to the policy of the host government regarding the acceptance of test data from laboratories accredited by other domestic or foreign accreditation systems.

D.3.5.2 On-site assessment

Before initial accreditation and regularly thereafter, an on-site assessment of each laboratory is conducted to determine compliance with the criteria. Assessors use standardised checklists so each laboratory receives a fair assessment in relation to others. However, assessors have considerable latitude in judgments about each laboratory's compliance with the criteria, depending on the unique circumstances of each laboratory. The assessors are selected and assigned on the basis of their expertise in the testing techniques to be reviewed. The time needed to conduct an assessment varies, but every effort is made to conduct an assessment with as little disruption as possible to the normal operations of the laboratory. The assessors:

- meet management and supervisory personnel responsible for the laboratory's activities for which accreditation is being sought to acquaint the individuals involved with the assessment process and to set the assessment agenda;

- examine the quality system employed by the laboratory, its major equipment, apparatus, and facilities;

- thoroughly review the laboratory's quality manual or equivalent, examine technician notebooks for records pertaining to the samples, check sample identification and tracking procedures, determine whether the appropriate conditions are maintained, and examine copies of completed test reports;

- review records of periodic internal audits;

- review representative records including competency evaluations for all testing laboratory staff members;

- observe demonstrations of testing techniques and discuss them with the technical personnel to assure their understanding of the procedures. If possible, the history of one or more samples from receipt to final issue of test reports is traced.

At the conclusion of the assessment, an exit briefing is held to discuss assessment findings with laboratory management and to identify any deficiencies uncovered. A written summary of all identified deficiencies is left at the laboratory. Assessment forms and a written report are submitted to the accreditation body for further evaluation. The laboratory is asked to respond within thirty days of the date of the exit briefing and provide documentation or proof that the

specific deficiencies have been corrected or that specific actions are being taken. Any laboratory applying for initial accreditation may request a delay in responding.

If any deficiencies are noted at laboratories which are currently accredited, such deficiencies should be corrected within thirty days after the exit briefing or the laboratory may face possible suspension, revocation, or expiration of its accreditation. When test systems are identified as malfunctioning, they should not be used until corrective action has been completed. Any deficiencies noted for corrective action should be subject to thorough review during subsequent assessments.

D.3.5.3 Monitoring visits

In addition to regularly scheduled assessments, monitoring visits can be made at any time during the accreditation period. Monitoring visits serve to verify reported changes in the laboratory's personnel, facilities, and operations, or to explore possible reasons for poor performance in proficiency testing. The scope of a monitoring visit may range from checking a few designated items to a complete review. Failure to cooperate with assessors or their representatives may be grounds for suspension or revocation of accreditation.

D.3.5.4 Proficiency testing

Proficiency testing is an integral part of the accreditation process. While the existence of facilities, equipment, and personnel which satisfy the criteria indicates a laboratory's overall capability to obtain good results, an analysis of actual test results for certain test methods is also necessary to determine if the overall capability does in fact produce the desired results. A laboratory's failure to participate fully in the conduct of required proficiency testing is grounds for adverse accreditation action.

D.3.5.5 Evaluation

Evaluation of a laboratory is conducted by technical experts approved by the accreditation body who review records on the applicant laboratory and base their decision on:

- information provided on the application;
- on-site assessment reports;
- actions taken by the laboratory to correct deficiencies;
- results of proficiency testing;
- information from any monitoring visits performed on the laboratory.

If the evaluation reveals additional deficiencies, written notification describing them should be made to the laboratory. The laboratory should respond within thirty days of receipt of such notification and provide documentation that the specified deficiencies have been corrected. Clari-

fication of some issues may be requested. All deficiencies should be corrected before accreditation can be granted or renewed.

D.3.5.6 Accreditation actions

The laboratory accreditation programme needs to address the issues of:

– recommendation: when accreditation is recommended, the recommendation forms the basis for granting accreditation;

– denial: in cases where denial is recommended, the laboratory is notified of such action and the reasons for denial are provided in writing;

– appeal: when denial has been proposed, the laboratory may request a hearing by the accreditation body; if satisfaction is not obtained, an appeal can be requested in writing to the control board;

– renewal: accreditation is granted for a given period of time with renewal occurring on the same anniversary date (the recommended accreditation duration is two years);

– termination: a laboratory may voluntarily terminate its accreditation by written request at any time;

– suspension: if an accredited laboratory develops problems or deficiencies which are of a temporary nature, its accreditation may be suspended until such time as the deficiencies are resolved;

– revocation: in cases where a laboratory is found to have violated the terms of its accreditation, the accreditation can be revoked. The laboratory may, however, be given the option to terminate accreditation voluntarily.

D.4 The process of certification

D.4.1 Initial contact

A client is free to contact the testing laboratory for conformance testing services either directly, or through a certification body. If conformance testing of the product is performed with intent to acquire a certificate of conformity, it is recommended the client contact the certification body early in the process.

D.4.2 Certificate of conformity content and presentation

A sample certificate of conformity is provided in figure D.2. Certificate of conformity depends on the set of standards and the specified period of time, which may not be uniform for all of the certification bodies. In addition to the IUT which underwent conformance testing for a certificate of conformity under a given SUT, the client has the option to claim (see figure

D.3) similar conformance for the IUT operating under other SUTs. These client claims are not covered by the certificate of conformity.

D.4.3 National responsibilities

In addition to establishing a national certification system based on this annex, P-member countries are encouraged to:

– assist and educate the appropriate audiences with regard to the scope and purpose of the conformance testing service as a measure of product conformance to a standard.

– identify publicity and announcement sources for informing the necessary national audience on the availability of the abstract test suite and conformance testing services.

– promote common recognition.

To help achieve common recognition (at both the national and international level) for conformance testing services, interaction is encouraged through:

a) the certification system providing the right for every testing laboratory representative to attend the conformance testing by any other testing laboratory once a year, which allows reciprocal observation to facilitate harmonisation;

b) allowing any client worldwide to address any certification body.

D.4.4 International (ISO TC184/SC4) responsibilities

ISO TC184/SC4 should:

– consider conformance testing aspects in the development of standards;

– provide advice and give technical committee or subcommittee recommendations to the control board for approval of a test method;

– provide technical advice when necessary on interpreting the standard to resolve conflict.

SAMPLE

certification body name and/or logo
Certificate of Conformity

date effective

This certificate is based on the test results detailed in the conformance testing report (CTR) referenced by the CTR number listed below. The processor has been conformance tested according to the standards, using the certification system listed below; however, the CTR should be reviewed to identify the implementation's more complete capabilities.

Certificate Holder: name of client

Processor Identification: processor name and version

System Under Test:

Hardware: list any hardware necessary

Hardware Options: hardware options

Operating System: operating system and version

Other Processor-Dependent Software: list any software necessary

Expiration Date: yyyy-mm-dd

Standard Reference: title, version

Implementation Under Test: processor and version

CTR #: serial number

Standard Under Review: No or Yes (see CTR)

Testing laboratory: Testing laboratory name

Signed: signature, certification body, certification mark

Certificate #: serial number

Figure D.2 – Sample certificate of conformity

SAMPLE

Additional SUT(s)

The supplier of the processor has completed and signed a declaration stating that the following environments produce the same results as those produced by the environment described on the certificate of conformity. These client claims are not covered by the certificate of conformity.

Certificate Holder: name of client

Processor Identification: processor name and version

Certificate #: serial number

Certificate Date: date effective yyyy-mm-dd

CTR #: serial number

Additional Environments:

a)

Hardware: list any hardware necessary

Hardware Options: hardware options

Operating System: operating system and version

Other Processor-Dependent Software: list any additional software necessary

b) (repeat as necessary)

Figure D.3 – Sample form for additional claims made by the client

Annex E
(informative)
Bibliography

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[3)] This was withdrawn in 1993 and incorporated into [7] and ISO/IEC Guide 58: 1993 *Calibration and testing laboratory systems — General requirements for operation and recognition.*

[4)] This was withdrawn in 1991 and incorporated into [7].

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