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Information technology — Requirements and Guidelines for Test Methods Specifications and Test Method Implementations for Measuring Conformance to POSIX Standards

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Abstract: This International Standard defines the requirements and guidelines for test method specifications and test method implementations for measuring conformance to POSIX standards. Test specification standard developers for other Application Programming Interface (API) standards are encouraged to use this standard. This document is aimed primarily at developers and users of test method specifications and implementations.

Keywords: assertion, assertion test, implementation under test, option, conformance document, conformance test procedure, conformance test software, test method implementation, test method specification, test result code

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IEEE Std 2003-1997 was prepared by the 2003 Working Group, sponsored by the Portable Applications Standards Committee of the IEEE Computer Society. At the time this standard was approved, the membership of the 2003 Working Group was as follows:

Portable Applications Standards Committee (POSIX)

Chair:	Lowell Johnson
Vice-Chair:	Joseph Gwinn
Secretary:	Nick Stoughton
Functional Chair of Balloting:	Jay Ashford
Functional Chair of Interpretations:	Andrew Josey
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2003 Working Group Officials

Chair:	Barry Hedquist*
	Roger Martin (1995)
	Lowell Johnson (1992-1995)
Vice-Chair:	Barry Hedquist
Editor:	Anthony Cincotta*
Secretary:	Keith Stobie (1992-1994)

Working Group

Don Cragun	Eric Lewine	Krys Supplee
Kevin Dodson	Kathy Liburdy	Ken Thomas
Shiela Frankel	Glenn McPherson	Andrew Twigger
Ken Harvey	Jerry Powell*	Bruce Weiner
David Hollenbeck	Tom Robinson	Fred Zlotnick
	William Sudman	

In the preceding list, those individuals identified with asterisks (*) served during the balloting period as Technical Reviewers for resolving comments and objections to designated portions of the standard.

The following persons were members of the 2003 Balloting Group that approved the standard for submission to the IEEE Standards Board:

Andy R. Bihain	James F. Leathrum	William R. Smith, Jr
Anthony Cincotta	Kevin Lewis	Keith Stobie
Donald Cragun	Kathy Liburdy	James G. Tanner
Michel Gien	Shane P. McCarron	Kenneth G. Thomas
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Information technology—Requirements and Guidelines for Test Methods Specifications and Test Method Implementations for Measuring Conformance to POSIX® Standards

Section 1: General

1.1 Scope

This International Standard is applicable to the development and use of conformance test method specifications for POSIX standards and may be applicable to other application programming interface specifications. This International Standard is intended for developers and users of test method specifications and test method implementations.

The users of this standard include

— Assertion Writers: to format assertions

— Assertion Test Writers: to write assertion tests

— Test Suite or System Procurers: to interpret the results of test suites

The purpose of this standard is to define requirements and guidelines for developing assertions and related test methods for measuring conformance of an implementation under test (IUT) to POSIX standards. Test method implementations may include Conformance Test Software (CTS), POSIX Conformance Test Procedures (CTP), and audits of Conformance Documents (CD).

Testing conformance of an implementation to a standard includes testing the capabilities and behavior of the implementation with respect to the conformance requirements of the standard. Test methods are intended to provide a reasonable, practical assurance that the implementation conforms to the standard. Use of

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these test methods will not guarantee conformance of an implementation to the standard; that normally would require exhaustive testing (see 7.2.1), which is impractical for both technical and economic reasons.

1.2 References

1.2.1 Normative References

The following standards contain provisions that, through references in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

{1} IEEE Std 729-1983,[1] *IEEE Glossary of Software Engineering Terminology (ANSI).*

1.2.2 Informative References

Several of the terms defined in 2.2.2, General Terms, have corresponding counterparts that are used in the international community for conformity assessment purposes. The references cited here use terminology and concepts that correlate to some of the terminology used in this standard.

{2} ISO/IEC 9646-1:1994, *Information technology—Open Systems Interconnection—Conformance testing methodology and framework—Part 1, General concepts.*

{3} ISO/IEC *Guide* 25:1990, *General Requirements for the Competence and Calibration of Testing Laboratories.*

1.3 Conformance Criteria

Test method specifications and implementations claiming to conform to this standard shall conform to all the requirements contained in this standard. Materials identified in this standard as *guidelines* or as *methodology* are suggestions or options, as are all examples, notes, and footnotes. All statements containing the term *shall* are requirements, as are statements where *shall* is obviously implied.

1) IEEE documents can be obtained from the The Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, PO Box 1331, Piscataway, New Jersey 08855-1331, USA.

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1.3.1 Test Method Specification Conformance Criteria

A test method specification conforming to this standard shall include all the following criteria:

— It shall use the required assertion definitions, types, syntax, and constructs specified in this standard as applicable (see Section 3).

— It shall use the test result codes specified in this standard for test results defined by this standard (see Section 4).

— It shall define any test method specification structures and test result codes it uses in addition to those defined by this standard.

— It shall specify a list of conforming test result codes that indicate conformance to the specifications being tested (see 4.3.1).

A conforming test method specification may specify other constructs not specified in this standard.

1.3.2 Test Method Implementation Conformance Criteria

Test method implementations that conform to this standard shall include all the following criteria:

— A test method implementation conforming to this standard shall document that it conforms to this standard and shall document any other test method specifications to which it claims to conform.

— The test method implementation shall test each instance for an assertion that specifies a set of instances often separated by the word *or*.

— The CTS shall be automated to the maximum extent possible.

— The documentation of the CTS shall include the following:

  — All information necessary to install, configure, and execute the CTS

  — The edition of the standard being tested

  — An overview of the CTS and the optional base standard features tested by the CTS

  — Deviances from the recommendations defined within this standard

  — Known limitations of the CTS

  — Release-specific changes

  — Configuration-specific parameters

  — Development system hardware requirements such as memory, disk space, terminal, and printer needs

  — Development system software requirements

  — Hardware and software requirements necessary to execute the CTS

  — A description of any CTS trouble-clearing procedures

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— The documentation of the test method implementations shall include, if needed, instructions for performing the CTP and an audit of the CD.

— The documentation of the test method implementations shall describe how to gather and interpret the results.

— Additional criteria may be specified in applicable standards.

When no test method specification exists, test method implementations shall derive the test method specifications from the base standards and the test method implementation shall then meet all the criteria listed above.

1.4 IUT Conformance Assessment

Figure 1-1 depicts the basic model for conformance assessment for an IUT where a test method standard is derived from an existing base standard by using this standard. The test method standard shall identify the test result codes that are required for conformance and provides the assertions from which test method implementations are derived. When a test method implementation is executed, it provides intermediate test result codes that must be resolved to final test result codes. When the final test result codes match the conformance test result codes, the implementation is judged to be conforming.

Note: This process does not include every potential step that may be required by a certifying body, such as a conformance document audit. It addresses only the relationship between the conforming test result codes identified in the test method standard and the final test result codes derived from the test method implementation.

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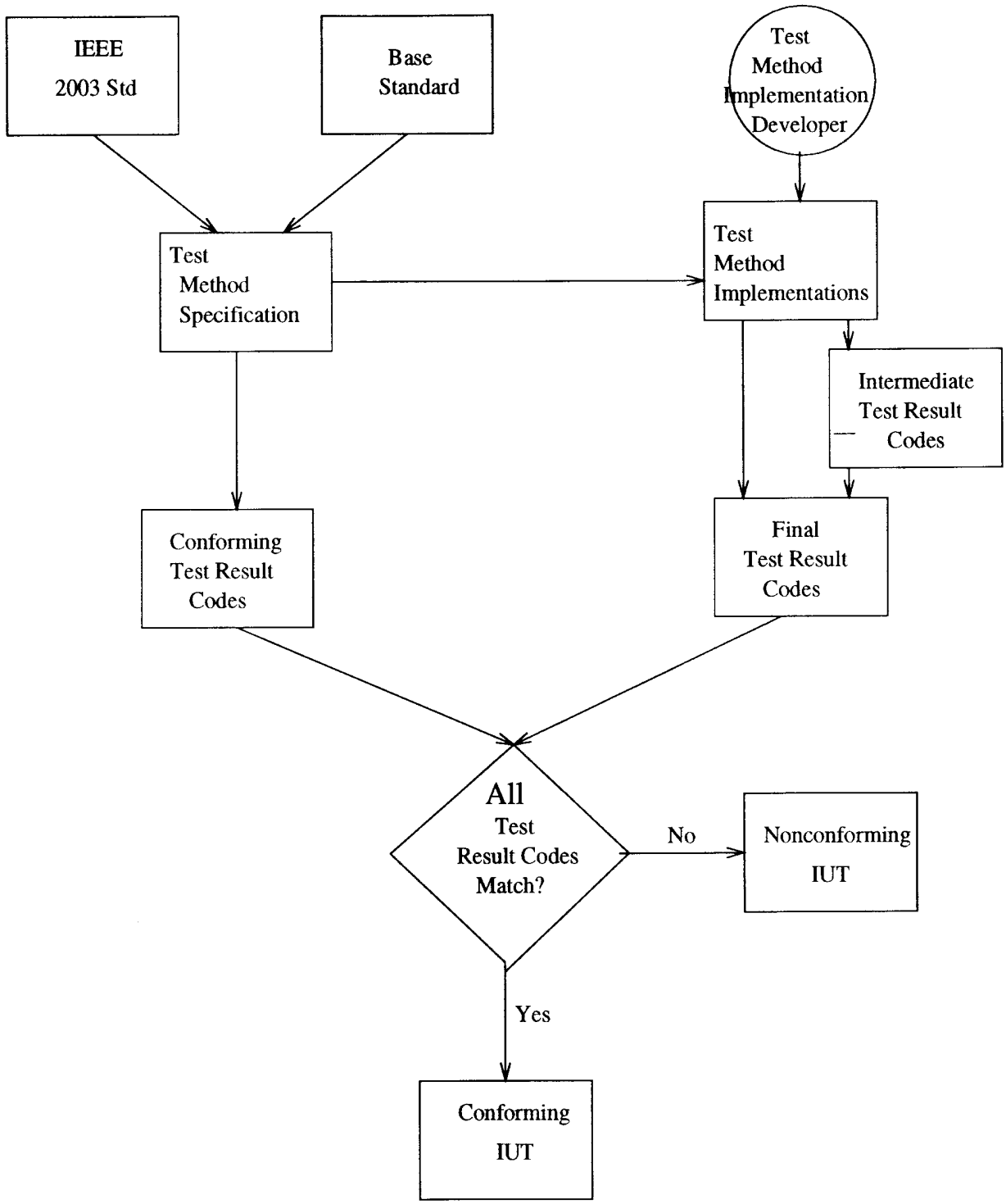
Figure 1-1 — Single Base Standard



1.4 IUT Conformance Assessment

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Section 2: Definitions and General Requirements

2.1 Conventions

This International Standard uses the following typographical conventions:

(1) The *italic* font is used for

— The initial appearances of defined terms

— Cross-references to defined terms in 2.2.1, 2.2.2, and 2.2.3

— Parameters (option arguments and operands) that generally are substituted with real values by the application

— C language data types and function names

— Global external variable names

— The element's trailing base standard subclause reference

(2) The **bold** font is used for

— Test result codes

(3) The `constant-width` (Courier) font is used

— To illustrate examples of system input or output where exact usage is depicted

— For references to utility names, element groupings, and C language headers

— Keywords used in assertions

(4) Symbolic test assertion parameters that are required are represented as <Test_Assertion_Parameter>.

(5) Headers are represented as `<header>`.

(6) The notation '()*' means that the production is repeated zero or more times.

(7) Symbolic test assertion parameters that are optional are represented as [Test_Assertion_Parameter].

(8) Symbolic *errno* constants returned by functions as error numbers are represented as [Symbolic_name].

(9) Symbolic constant limits are represented as {Symbolic_constant_limit}.

(10) Symbolic constant options are represented as {Option_name}.

(11) Notes provided as parts of labeled tables and figures are integral parts of this standard (normative). Footnotes and notes within the body of the text are for information only (informative).

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(12) Defined names that are usually in lowercase, particularly function names, are never used at the beginning of a sentence or anywhere else where regular English usage would require them to be capitalized.

(13) Mathematical symbols such as <, ≤, etc., are used only in formulas, assertion classification assignments, and conditional clauses preceding conditional assertions.

(14) In some cases tabular information is presented "inline"; in others it is presented in a separately labeled table. This arrangement was employed purely for ease of typesetting, and there is no normative difference between these two cases.

(15) The double quote ("name") is used when a name is specified.

(16) The single quote ('value') is used when a specific value is specified.

(17) The conventions listed above are for ease of reading only. Editorial inconsistencies in the use of typography are unintentional and have no normative meaning in this standard.

(18) All assertion examples are written in 9-point text.

A summary of typographical conventions is shown in Table 2.1.

Table 2-1 – Typographical Conventions

Reference	Example
C Language header	`<sys/stat.h>`
Data types	*long*
Defined terms	*file*
Environment variables	**PATH**
Error number	[EINTR]
File name	`filename`
Function argument declaration	unsigned long int
Function argument	*arg1*
Function declaration	long int
Function name	*funct*()
Global external	*errno*
IEEE Std 1003.n-19xx reference	*POSIX.n*
Implementation-dependent limit	{MAX_INPUT}
Metacharacter	* (any character string)
Parameters	*<path>*
Reference to other standards	[ISO Guide 25]
Section x.y reference	See x.y or x.y
Special character	`<newline>`
Symbolic constant limit	{LINK_MAX}
Symbolic constant option	{_POSIX_JOB_CONTROL}
Symbolic constant value	_POSIX_JOB_CONTROL
Symbol defined in header	_POSIX_JOB_CONTROL
Table reference	Table 2-1
Utility name	`tar`
Variable	*st_atime*

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2.2 Definitions

2.2.1 Terminology

For the purpose of this International Standard, the following definitions apply.

2.2.1.1 may: An option for test method specifications or implementations.

In this standard, *need not* is used as the negative of *may*.

2.2.1.2 must: The same as *shall*.

2.2.1.3 shall: A requirement for test method specifications or implementations.

2.2.1.4 should: A recommended practice for test method specifications or implementations.

2.2.2 General Terms

2.2.2.1 assertion: The specification for testing a *conformance requirement* in an IUT in the forms defined in this standard. It defines what to test and is **TRUE** for a *conforming implementation*. Assertions are the basic entities for test method specifications and test method standards.

2.2.2.2 assertion identifier: The identifier assigned to an *assertion*. It consists of characters from the *portable identifier character set* and follows the name space requirements specified in 3.3.1 and other conventions that may be specified by *test methods standards* conforming to this standard.

The name of the *element* and the *assertion identifier* together shall uniquely identify an *assertion* within a *test method specification*. See 3.3.1 for examples of assertion identifiers.

2.2.2.3 assertion test: The software or procedural methods that generate the *test result* codes used for assessment of *conformance* to an *assertion*.

2.2.2.4 base standard: The standard for which a *test method specification* is written and/or a *test method implementation* is developed.

2.2.2.5 conformance: [ISO/IEC Guide 25] Fulfillment by a product, process, or service of all relevant specified *conformance requirements*. [JTC-1]

2.2.2.6 conformance document (CD): The *conformance document* required by the standard that meets the requirements specified in that standard for such a document.

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2.2.2.7 Conformance Documentation Audit: The process of reviewing a *Conformance Document* to ascertain that it meets the requirements of a *base standard* as specified by *documentation assertions*.

2.2.2.8 conformance log: [ISO/IEC 9646-1] A human-readable record of information, produced as a result of a testing session, that is sufficient to verify the assignment of *test results* (including *test verdicts*). [JTC-1, generalized]

2.2.2.9 conformance requirement: A requirement stated in a *base standard* that identifies a specific requirement in a finite, measurable, and unambiguous manner. A *conformance requirement* by itself or in conjunction with other conformance requirements corresponds to an *assertion*.

NOTE: [ISO/IEC Guide 25]
Behavior and/or capabilities imposed upon an implementation by the *base standard* for the implementation to conform to that *base standard*. [JTC-1, modified]

2.2.2.10 Conformance Test Procedure (CTP): Manual procedures used in conjunction with other test methods to measure *conformance*.

2.2.2.11 Conformance Test Software (CTS):
Test software used to ascertain *conformance* to standards.

2.2.2.12 conformance testing: [ISO/IEC 9646-1] Testing the extent to which an *implementation under test* is a *conforming implementation*. [JTC-1]

2.2.2.13 conforming implementation: [ISO/IEC 9646-1] An implementation that satisfies all relevant specified *conformance requirements*. [JTC-1, generalized]

2.2.2.14 conforming test result codes: The complete list of *test result codes* associated with each *assertion* that a CTS can report for a *conforming implementation*.

2.2.2.15 CTS build system: The hardware and software used to compile and configure a CTS.

2.2.2.16 CTS execution system: The hardware and system software on which the CTS is executed.

2.2.2.17 documentation assertion: An *assertion* generated by a requirement in the *base standard* being tested that a specific feature or behavior be documented.

2.2.2.18 element: A functional interface or a namespace allocation.

Examples of *elements* are functions and utility programs. Examples of namespace allocation include headers and error return value constants.

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2.2.2.19 final test result code: A *test result code* obtained from an *assertion test* that requires no further processing.

2.2.2.20 formal test specification: A specification of the *assertion test* using a formal method specified by the *test method specification*. The *test method specification* shall specify whether the *formal test specification* is normative or informative.

2.2.2.21 implementation: That which implements the requirements of a *base standard*, or a profile.

Test method specifications shall define specifically what an implementation is within the meaning of that specification.

Implementation, as used here, is not to be confused with implementation-defined.

2.2.2.22 implementation under test (IUT): That which implements the standard(s) being tested. An IUT may consist of hardware and software located on different systems.

Test method specifications shall define specifically what an implementation is composed of within the meaning of that specification.

2.2.2.23 intermediate test result code: A *test result code*, obtained from an *assertion test*, that requires further processing to determine the *final test result code* (see 4.2.2).

2.2.2.24 logical expression: An expression of boolean terms that may be combined using logical *and* (&&) and *or* (||) operators that evaluate to either **TRUE** or **FALSE**. The resulting value is used to determine which branch of an 'If ... Else' condition to take.

2.2.2.25 option: Any behavior or feature defined in the *base standard* that need not be present in all *conforming implementations*.

2.2.2.26 portable identifier character set: The set of characters from which portable identifiers are constructed. This set shall consist only of the following characters:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
a b c d e f g h i j k l m n o p q r s t u v w x y z
0 1 2 3 4 5 6 7 8 9 . _ ( ) -

2.2.2.27 system under test: The computer system hardware and software on which the *implementation under test* operates.

2.2.2.28 test case: [ISO/IEC 9646-1] A specification of the actions required to achieve a specific test purpose or combination of test purposes. In OSI, test cases can be generic, abstract, or executables. [JTC-1]

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2.2.2.29 test method implementation: The software, procedures, or other means used to measure *conformance*. For PASC, *test method implementations* may include a CTS, a CTP, or an audit of a CD.

2.2.2.30 test method specification: A document that expresses the required functionality and behavior of a *base standard* as *assertions* and provides the complete set of conforming *test result codes*.

2.2.2.31 test method standard: A *test method specification* that has been adopted as a standard.

2.2.2.32 test purpose: [ISO/IEC 9646-1] A prose description of a narrowly defined objective of testing, focusing on a single *conformance requirement*, as specified in the appropriate product specification (i.e., verifying the support of a specific value or a specific parameter). [JTC-1]

2.2.2.33 test report: [ISO/IEC Guide 25] A document that presents *test results* and other information relevant to the execution of the *test methods* against an IUT. [JTC-1, modified]

2.2.2.34 test result code: A value that describes the result of an *assertion test*.

This is equivalent to *test verdict* in ISO/IEC Guide 25.

2.2.2.35 test software: [ISO/IEC Guide 25] Software used in order to carry out or assist in carrying out the testing required. [JTC-1]

2.2.2.36 test support: Those facilities not specified by the standard(s) being tested, or specified but not required, that need to be provided by the SUT in order to perform an *assertion test*.

2.2.2.37 testing constant: A constant that is not specified in the standard being tested but is required by an assertion test to test an *assertion*.

2.2.2.38 verdict criteria: [ISO/IEC Guide 25] See *conforming test result codes*.

2.2.3 Abbreviations

For the purposes of this standard, the following abbreviations apply:

2.2.3.1 IEEE: Institute of Electrical and Electronics Engineers

2.2.3.2 IUT: implementation under test

2.2.3.3 OSE: Open System Environment

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2.2.3.4 PASC: Portable Applications Standards Committee

2.2.3.5 CD: Conformance Document

2.2.3.6 CTP: Conformance Test Procedures

2.2.3.7 CTS: Conformance Test Software

2.2.3.8 POSIX: Portable Operating System Interface[2)]

2.2.3.9 POSIX.n: IEEE Std 1003.n-xxxx[3)]

2.2.3.10 SUT: system under test

2) Used as a name for the collection of IEEE 1003 standards, draft standards, and projects.

3) Term used to refer to a specific IEEE P1003.n project or its products. For example, POSIX.1 represents the P1003.1 project and its associated products, ISO/IEC 9945-1: 1990, IEEE Std 1003.3-1991, and IEEE Std 2003.1-1992 {4}.

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Section 3: Assertion Definitions, Types, Syntax, and Constructs

3.1 Introduction

This section defines required assertion types (see 3.3) and the syntax that shall be used in writing assertions. Section 8 describes the creation of assertions from a base standard.

An assertion is a statement of functionality or behavior for one or more elements, sufficient in detail that test method implementors can code assertion tests, that is derived from one or more requirements of a base standard. Assertions are stated so that a test result code of **PASS** indicates conformance to the standard.

Test method specifications may choose to use other assertion definitions, types, syntax, and constructs. If a test method specification chooses to deviate from what is specified in this standard, it shall document in detail the assertion definitions, types, syntax, and constructs used. All assertions shall have at least two additional components associated with them:

— An assertion identifier as defined in this standard

— Conforming Test Result Codes (see 4.3.1)

An assertion may require multiple preconditions. Preconditions include all the items listed in Figure 3-1 leading up to <Test_Text>. All, or none, of the preconditions described may or may not be applicable to a given assertion.

The names defined in this section contained within the < > characters are symbolic names. They are used to characterize specific details that shall be provided in writing assertions. The details required by these symbolic names shall be provided when applicable. They shall not be used when not applicable.

A test method specification shall provide complete coverage of the base standard. The test method specification is written for the developer of the test method implementation and, when properly employed, provides an authoritative means to indicate conformance to a base standard without ambiguity. The assertions generated shall be complete, understandable, and correct.

The test methods shall be organized according to the same sections, clauses, and subclauses in the corresponding POSIX standard.

Assertions shall be written only for conformance requirements.

No assertions shall be written for a statement that applies only to the usage of an implementation rather than to the implementation itself.

No assertion shall be written for a statement that uses definitive terminology in a statement that is meant to be only a warning to programmers or an implementation recommendation.

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3.2 Generic Assertion Structure

<Generic_Assertion> refers to the generic assertion structure represented in Figure 3.2. The only required text for a <Generic_Assertion> is the <Test_Text>, except for General Assertions and General Documentation Assertions that require both the 'For' construct and the <Test_Text>.

Figure 3-1 – Generic Assertion Structure

```
For <Element_1>, ..., <Element_n>:
If <Applicable_Standard> then
  If <Option> then
    If <Test_Support> then
        (Setup:  <Setup_Requirements>)*
        Test:    <Test_Text>
        (TR:     <Testing_Requirements>)*
        (Note:   <Notes>)*
     Else <No_Test_Support>
   Else <No_Option>
Else <No_Applicable_Standard>
```

This structure provides the basis for each of the assertion types defined in this section. The specification for each line of the generic assertion structure shall be identified when applicable. <Test_Text> is always applicable to a generic assertion.

Test method specifications are allowed flexibility in the representation of specific terms identified in this structure; however, such representation shall be editorially consistent. For example, else may be represented as else, ELSE, ELSE:, Else, etc., as long as the representation is consistent.

If, in traversing an assertion from top to bottom, a precondition is not supported by the SUT or IUT, then the outcome for the assertion is mandated by its corresponding 'Else' specification.

3.2.1 For

If a feature or behavior is similar across multiple elements, the 'For' construct is allowed as a method of specifying identical requirements to multiple elements in an accurate and concise manner. This structure normally is used in writing general assertions.

'For' may be used as a looping construct similar to that found in programming languages. It may list a set of functions or constants that are to be substituted for parameters referenced in the body of the assertion.

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3.2.2 If then Else

The construct 'If <precondition>, then ... Else <outcome>' is used to specify a requirement needed to test an assertion. This is represented in the assertion structure by the 'If <precondition>' clause when the requirement is not met by the 'Else <outcome>' clause.

When the precondition is supported by the SUT, the 'If' clause evaluates as **TRUE**. When the precondition is not supported by the SUT, the 'If' clause evaluates as **FALSE** and the corresponding 'Else' clause determines the outcome to be reported.

This construct provides a straightforward approach to assigning an outcome to an assertion when a required precondition is not provided.

3.2.3 Applicable Standard

<Applicable_Standard> represents the base standards applicable for testing this assertion. <Applicable_Standard> may simply be the single base standard from which the assertion is derived or multiple base standards to which the assertion applies. This parameter may be represented in a logical expression.

3.2.4 Option

<Option> represents any behavior or feature defined in the base standard that need not be present in all conforming implementation. This parameter may be represented as a logical expression.

3.2.5 Test Support

<Test_Support> represents those facilities not specified, or specified but not required, by the standard(s) being tested that are needed by an SUT to perform an assertion test. Test method specifications may need the support of nonrelated optional features in the system under test in order to test an implementation thoroughly.

3.2.6 Setup Requirements

<Setup_Requirements> are the steps that a test program or tester must perform to set up the proper environment for performing the test of an assertion. <Setup_Requirements> may have one or more steps. <Setup_Requirements> are instructions to create the appropriate test environment. If a setup requirement step does not succeed, a conforming test method shall report which step failed and, to the largest extent possible, the reason for failure. If any setup step does not succeed, the test result code reported for the assertion shall be **UNRESOLVED**.

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3.2.7 Test Text

<Test_Text> specifies the test to be performed. The text usually takes the form

<action> <result>

When an assertion requires multiple tests, a list or table may be provided to define the minimum number of items to be tested.

3.2.8 Testing Requirements

<Testing_Requirements> specifies the minimal testing that is required for an assertion. It typically is specified when an assertion allows more than one way to test it. For example, an assertion having to do with some property of a file could be tested for a single type of file, or several types, or all types for which the property is valid. A testing requirement should be used to specify the required minimum set of file types to test in such a circumstance.

<Testing_Requirements> may depend on the context of the assertion. Thus it is possible for a single assertion to have multiple testing requirements each of which is applicable to a specific assertion context.

When an assertion requires many tests in order to test it thoroughly, a list or table containing the test parameters may be provided in place of repetitive text.

3.2.9 Notes

<Notes> represent additional information that should be known to those using the test method specification.

3.3 Assertion Types and Constructs

Depending on the text of the base standard, each assertion structure shall have one of five possible forms to correspond to the five assertion types. These assertion types are

— Basic

— General

— Reference

— Documentation

— General Documentation

Each of these assertion structures is based on the generic assertion structure shown in Figure 3-1.

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3.3.1 Assertion Identifiers

Each assertion has an assertion identifier that is indicated in the assertion structure by any of the symbols <Assertion_Identifier>, <D_Assertion_Identifier>, <GA_Assertion_Identifier>, <GD_Assertion_Identifier>, <R_Assertion_Identifier>. The guideline for writing assertion identifiers, indicated by the symbol <Assertion_Identifier>, recommended by this standard is as follows: If other conventions are used, they shall be specified by test methods specifications conforming to this standard:

[(<specification_list>)]<Assertion_Type><portable_identifier_chars>

Where <specification_list> is a comma-separated list of standards and specifications to which the rest of the assertion identifier applies; it is optionally present and is enclosed in parentheses if it is present. The <Assertion_Type> indicates the type of the assertion and is one of the types specified below or another type specified by the test methods specification in which it appears. The <portable_identifier_chars> are the set of characters from the portable identifier character set that give the assertion its identification or name. Note that there are no spaces allowed in an <Assertion_Identifier> and that the only places where commas may appear are in the <specification_list>.

The following characters are reserved for <Assertion_Type> and shall be used only for the type of assertion indicated; the indicated symbol as used in this standard indicates the specified type of <Assertion_Identifier>. Test method specifications shall define the assertion identifier conventions employed. See Figure 3-2.

Figure 3-2 – Assertion Types

<Assertion_Type>	Type of Assertion	Assertion Identifier Symbol
D_	Documentation Assertion	<D_Assertion_Identifier>
GA_	General Assertion	<GA_Assertion_Identifier>
GD_	General Documentation Assertion	<GD_Assertion_Identifier>
R_	Reference Assertion	<R_Assertion_Identifier>
<NULL>	Basic Assertion	<Assertion_Identifier>

Examples of assertion identifiers that meet the recommended guidelines are

23
GA_17
GA_stdC_proto_decl
D_5
17.35
R_erofs
(2003.1-1990)GA_10 - Means GA_10 in IEEE Std 2003.1-1990 standard.
(2003.1-1990, 2003.4-1995)15 - Means assertion 15 in both standards stated.

The following subclauses specify the layout for each assertion type. Section 4 provides examples for writing assertions for each assertion type by using the actual text from ISO/IEC 9945-1: 1990 to derive assertions and provide assertion layouts.

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3.3.2 Basic Assertion

The symbolic <Basic_Assertion> represents one or more standard requirements with respect to a single element. A <Basic_Assertion> shall be written to conform to the assertion structure of Figure 3-3.

Figure 3-3 – Basic Assertion Structure

```
<Assertion_Identifier>  <Generic_Assertion>
```

3.3.2.1 Assertion Identifiers for Basic Assertions

The <Assertion_Identifier> is unique to each <BASIC_ASSERTION> within an element. These identifiers should be numeric and may contain a decimal point and a fractional part. The assertion associated with such an identifier should be placed in numeric sequence relative to other numbered assertions. Assertions with non-numeric assertion identifiers may be placed in any sequence, including interspersed between assertions with numeric assertion identifiers. The use of a numeric assertion identifier shall not imply a particular sequence for testing assertions.

3.3.3 General Assertions

General assertions are statements of behavior or functionality derived from a base standard that apply to more than one element and expand into one or more assertions specific to each element.

General assertions shall be uniquely identified within a test method specification. The test method specification shall document in an index the location of each general assertion.

The symbolic <General_Assertion> represents the standard's requirements that affect multiple elements in a similar manner. Each general assertion results in one or more assertions for each of the elements listed or implied. General assertions shall be written to conform to the assertion structure of Figure 3-4. The 'For' construct shown in Figure 3-1, Generic Assertion Structure, is required for each General Assertion.

Figure 3-4 – General Assertion Structure

```
<GA_Assertion_Identifier>
    <Generic_Assertion>
```

For each element listed or implied by a general assertion, a basic assertion will be generated for that element using the structure shown in Figure 3-3 and a reference to its corresponding <General_Assertion>. These basic assertions shall be written to conform to the assertion structure of Figure 3-5.

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