

# IEEE Standards Style Manual

## 1. Overview

This manual establishes preferred style for the preparation of proposed IEEE standards. IEEE Standards project editors are available for advice and assistance throughout this process. Please note that many of the suggested guidelines can be adapted and restructured to suit the needs of a particular group; however, it is strongly recommended that working groups consult with IEEE Standards project editors before deviating from this style. Failure to follow the requirements (shall) or recommendations (should) of this manual may result in delayed approval of the draft standard by the IEEE Standards Association Standards Board or delayed publication of the standard.

This 2007 Edition of the *IEEE Standards Style Manual* is applicable to all drafts submitted for IEEE Sponsor ballot or to the IEEE-SA Standards Board after 1 June 2007. A file showing highlighted changes to the 2005 Edition of the *IEEE Standards Style Manual* is available from the IEEE Standards Web site <<http://standards.ieee.org/guides/style/index.html>>. Any comments or queries concerning this document should be forwarded to an IEEE Standards project editor via e-mail ([stds-style@ieee.org](mailto:stds-style@ieee.org)) or directly to the staff liaison. The e-mail must contain a clear description of the relevant text and the recommended changes, where applicable.

This manual is not intended to be a guide to the procedural development of standards.<sup>1</sup> Recommended manuals on this subject are the *IEEE-SA Standards Board Bylaws* [B4]<sup>2</sup>, the *IEEE-SA Standards Board Operations Manual* [B6], and the *IEEE-SA Standards Companion* [B5], also published by the IEEE Standards Activities Department.<sup>3</sup> For examples of IEEE Standards style of drafts, please see Annex B. An example amendment can be found in Annex C.

## 2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ANSI Y32.9, American National Standard Graphic Symbols for Electrical Wiring and Layout Diagrams Used in Architecture and Building Construction.<sup>4</sup>

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<sup>1</sup>While this manual uses the term “standard,” its rules apply generically to guides and recommended practices as well.

<sup>2</sup>The numbers in brackets correspond to those in the bibliography in Annex A.

<sup>3</sup>All IEEE Standards manuals are available on the IEEE Standards Web site <<http://standards.ieee.org/guides/index.html>>. Users are encouraged to visit this site for the most up-to-date information.

ANSI/IEEE Std 260.3™, American National Standard for Mathematical Signs and Symbols for Use in Physical Sciences and Technology.

ANSI/IEEE Std 260.4™, American National Standard Letter Symbols and Abbreviations for Quantities Used in Acoustics.

IEEE Std 91™, IEEE Standard Graphic Symbols for Logic Functions.<sup>5,6</sup>

IEEE Std 260.1™, IEEE Standard Letter Symbols for Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

IEEE Std 270™, Standard Definitions for Selected Quantities, Units, and Related Terms, with Special Attention to the International System (SI).

IEEE Std 280™, IEEE Standard Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

IEEE Std 315™, IEEE Standard Graphic Symbols for Electrical and Electronics Diagrams (Including Reference Designation Letters).

IEEE Std 945™, IEEE Recommended Practice for Preferred Metric Units for Use in Electrical and Electronics Science and Technology.

IEEE Std 991™, IEEE Standard for Logic Circuit Diagrams.

IEEE/ASTM SI 10, American National Standard for Use of the International System of Units (SI): The Modern Metric System.<sup>7</sup>

### 3. Responsibilities of the working group chair and sponsor

The sponsor/working group chair of each project shall be responsible for submitting the draft of the standard for mandatory editorial coordination (MEC). This coordination is initiated at the start of the ballot invitation period prior to the Sponsor ballot. The first MEC review shall be completed before the Sponsor ballot begins. IEEE Standards project editors review the draft mainly for editorial and structural issues that may impact approval, and for legal, safety, and intellectual property issues that should be resolved prior to distributing the draft in ballot. Mandatory coordination for terms and definitions by Standards Coordinating Committee 10 (SCC10) and for quantities, units, and letter symbols by Standards Coordinating Committee 14 (SCC14) occurs automatically during the Sponsor ballot. Mandatory coordination for the registration of objects by the IEEE Registration Authority Committee (RAC) occurs during the Sponsor ballot if the Project Authorization Request (PAR) indicates that the possible registration of objects or numbers is to be included in or used by the project and/or if it becomes apparent through development of the draft that the registration of objects or numbers will be included in or used by the RAC and/or otherwise requested by the RAC.

When ballot consensus is reached, the sponsor of each project shall be responsible for reviewing the final draft to ensure that it is the complete and accurate document approved by the balloting group, that it meets the requirements of this manual, and that it is ready to be submitted to the IEEE-SA Standards Board. When

<sup>4</sup>This publication, as well as the subsequent ANSI standards appearing in this clause, are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08854, USA (<http://standards.ieee.org/>).

<sup>5</sup>IEEE publications are available from the Institute of Electrical and Electronics Engineers, 445 Hoes Lane, Piscataway, NJ 08854, USA (<http://standards.ieee.org/>).

<sup>6</sup>The IEEE standards or products referred to in this clause are trademarks of the Institute of Electrical and Electronics Engineers, Inc.

<sup>7</sup>Formerly numbered IEEE Std 268.

approved by the IEEE-SA Standards Board, the draft will be prepared for publication by the IEEE Standards project editor.

The sponsor or a designated representative (usually the working group technical editor or chair) shall serve as the liaison between the working group and the IEEE Standards project editor. During the publication process, the sponsor or designee is given the opportunity to answer questions and to review the document when it is in its final stages of production to ensure that editorial changes have not affected the technical content of the standard.

## **4. Items to submit to the IEEE**

### **4.1 Editorial requirements for submission**

The sponsor of an IEEE Standards project shall be responsible for providing the IEEE-SA Standards Board with a complete, technically accurate draft of the proposed standard that meets the requirements of this manual for content, style, and legibility. Any draft standard that is intended for IEEE Sponsor ballot should use the IEEE templates available on the official IEEE Standards Web site (see 4.2.1). It is strongly advised that drafts be developed using the official template, otherwise there may be delays during publication. A cover letter or e-mail also should be submitted that states the software application/program (including version number) used to create the document, order of files on the disk, etc. (See 4.3 for further information on submittal to the IEEE-SA Standards Board.) If applicable, written permission for any copyrighted material (text, figures, or tables obtained from an outside source) used within a project shall be submitted to the IEEE-SA Standards Board as well (see 5.2).

During the ballot invitation period prior to balloting, the sponsor is required to submit online the draft and any relevant copyright permission letters for mandatory editorial coordination, which may include a legal review. IEEE Standards project editors are also available for questions that arise as the draft is prepared.

### **4.2 Requirements for the draft**

#### **4.2.1 Draft development**

All IEEE drafts should be developed using an IEEE-approved document template available from the IEEE Standards Web site <<http://standards.ieee.org/resources/development/writing/templates.html>>. The drafts should contain a front matter and main text, and follow the style outlined in this manual. The draft pages should be numbered consecutively. The front matter shall contain the title of the standard (see 9.1), draft copyright statements (see 4.2.2), an abstract and keywords (see 9.2), and an introduction that includes a patent statement, a list of the working group members, and a statement describing the type of ballot conducted (see 9.3). Working groups are encouraged to consult with an IEEE Standards project editor if there are any questions concerning electronic tools used to develop IEEE drafts. (See Annex B for an example draft standard.)

During Sponsor ballot, balloters may submit comments that refer to the content of the balloted draft. To facilitate identification of the location of the content (text, figures, tables, etc.) being discussed, it is recommended that drafts be formatted to include line numbering. Line numbers should appear in the margins of the first page and should restart in the margins of each subsequent page. More information regarding how to format drafts to include line numbering is found in the documentation associated with the IEEE Standards templates online at: <<http://standards.ieee.org/resources/development/writing/templates.html>>.

#### **4.2.2 Draft copyright statements**

All IEEE drafts are obligated to carry statements of copyright, as indicated by the PAR. As per legal counsel, the following information shall appear at the bottom of the title page of every IEEE Standards draft (please note that <current year> shall be replaced with the current year of distribution):

Copyright © <current year> by the IEEE.  
Three Park Avenue  
New York, NY 10016-5997, USA  
All rights reserved.

This document is an unapproved draft of a proposed IEEE Standard. As such, this document is subject to change. USE AT YOUR OWN RISK! Because this is an unapproved draft, this document must not be utilized for any conformance/compliance purposes. Permission is hereby granted for IEEE Standards Committee participants to reproduce this document for purposes of international standardization consideration. Prior to adoption of this document, in whole or in part, by another standards development organization, permission must first be obtained from the IEEE Standards Activities Department (stds.ipr@ieee.org). Other entities seeking permission to reproduce this document, in whole or in part, must also obtain permission from the IEEE Standards Activities Department.

IEEE Standards Activities Department  
445 Hoes Lane  
Piscataway, NJ 08854, USA

The following information shall appear on every page of the draft, at the bottom of the page:

Copyright © <current year> IEEE. All rights reserved.  
This is an unapproved IEEE Standards Draft, subject to change.

#### 4.2.3 Draft labeling

All copies of the draft shall be clearly labeled to reflect that they are not yet approved standards. The title of the document shall start with the word *Draft*. The term *IEEE* shall not be used in a title until a standard is approved by the IEEE-SA Standards Board. The draft designation and the date of the draft shall appear in the upper right corner of each page of the draft. The designation and date shall not be combined. (See Annex B for examples of appropriate draft labeling.)

The IEEE standards designation shall be structured, at a minimum, as *IEEE Pxxx/DXX*, where *xxx* represents the specific designation and *XX* represents the specific draft version of that document (see Table 1 for examples of designation formats). Draft versions shall be maintained, and are most important during a ballot; the draft number should be updated as least as often as the document is modified and/or recirculated.

Standards designations are allocated by the Administrator of the IEEE-SA Standards Board New Standards Committee (NesCom). Requests for specific designations should be submitted to the NesCom Administrator for consideration. Any additional labeling may be included at the discretion of the working group.

#### 4.2.4 Corrections

Corrections or changes to the final balloted draft that do not affect the technical content of the standard (e.g., grammatical changes and changes to style) may be submitted along with the submission of the final balloted draft to the Review Committee (RevCom) for approval by the IEEE-SA Standards Board. The corrections or changes to the final balloted draft should be listed in a separate file, and a description should be provided to indicate where they are to be inserted into the text. If corrections are extensive, a new corrected draft shall be submitted with changes clearly indicated by strikethroughs for deleted text and underscores for new text. Changes to figures or tables shall be clearly indicated. During the publication process, the IEEE Standards project editor will determine whether the corrections or changes are acceptable. Corrections or changes that are not accepted may be submitted for consideration in a future amendment, corrigendum, or revision of the standard. The corrections submitted after ballot shall be implemented as judged appropriate by the IEEE Standards project editor, i.e., corrections may or may not be implemented based on the judgement of the

**Table 1—Examples of draft designations**

Type of draft	Example draft designations	Comments
Draft base standard	IEEE P1234/D1	IEEE designations are assigned by the NesCom Administrator to whom special designation requests should be submitted.
Draft standard that is a part of a group of standards	IEEE P1234.1/D1, IEEE P1234.2/D1, etc.	A group of standards may or may not be derived from a single base, e.g., derived from IEEE 1234.
Draft amendment to a base standard	IEEE P1234a/D1, IEEE P1234b/D1, etc.  IEEE P1234.1a/D1, IEEE P1234.1b/D1, etc.	Letters are only used in designations to indicate amendments to a base document (lowercase letters only). The lowercase letter shall follow the designation of the standard that is being amended.
Draft corrigendum to a base standard	IEEE P1234-200x/Cor 1/D1, IEEE P1234-200x/Cor 2/D1, etc.	Designations for corrigenda always refer to the base document being corrected, even if the base has been amended.
Draft conformance document to a base standard  Single conformance document          Multipart conformance document	IEEE P5678/D1  IEEE P11234/D1          IEEE P1234/Conformance01/D1, IEEE P1234/Conformance02/D1, etc.	A single conformance document can have a designation that is either unrelated to, or related to, the base. Related designations usually contain the designation of the base document preceded by a digit. The example shown has the digit 1 preceding the base designation IEEE 1234.  This format shall always be used for multipart conformance documents.

editor. If changes are required, another recirculation of the draft should be conducted, and the corrections should be included in the recirculated draft.

Technical changes shall not be made to a draft after balloting without recirculation, and certain editorial changes that are extensive (i.e., considered substantial) or that affect the meaning of the text may require recirculation as well.

### 4.3 Submission of IEEE drafts to the IEEE-SA Standards Board

The electronic files (i.e., files submitted for Board review, as well as the source files) of the draft standard submitted to the IEEE-SA Standards Board shall be an *exact match* of the complete final version of the balloted draft. The submitted files shall include any unpublished draft references that are included as part of the normative references and any files developed by the working group for use with the standard. Any documents or files that are linked by cross-reference to an Internet location shall also be submitted to the IEEE-SA Standards Board and hosted on an IEEE Standards Web area. Appropriate permission shall be obtained for documents or files that are copyrighted by other organizations (see Clause 5). Any discrepancies regarding submitted files can cause serious delays in publication, and the IEEE-SA Standards Board may withhold approval until the correct electronic files are submitted.

For electronic submittal, the use of PC- or Macintosh-based file compression software to “zip” or “stuff” files is encouraged so that files may be transferred via e-mail. File transfer via File Transfer Protocol (FTP) or CD-ROM is an option for delivery of large electronic files. Compressed files should be created as “automatically self-extracting” so that they can be opened by IEEE Standards Activities Department staff without the need for expansion software.

The IEEE Standards Activities Department accepts electronic graphics files and electronic documents using IEEE Standards templates, which are available from the IEEE Standards Web site, <<http://standards.ieee.org/resources/development/writing/templates.html>>, as follows:

- *Word processing programs*: Files created in Microsoft Word® for Windows® and Macintosh® are accepted.
- *Desktop publishing programs*: Files created using the desktop publishing program FrameMaker® are accepted. Check with an IEEE Standards project editor before creating files in FrameMaker. Those working groups with the capability of working in SGML or XML, should also contact an IEEE Standards project editor.
- *Graphics programs*: For information on creating and submitting graphics, see 16.1.

Working groups should consult with an IEEE Standards project editor for submission of files in formats other than those listed previously. Working groups should be aware that submission of documents in templates other than those provided by the IEEE may result in delays in the publication of the standard.

IEEE has strict rules concerning the electronic posting of draft standards. It is permissible to place draft standards on a password-protected site for access by members of the working group or task group responsible for the development of the document. Draft standards shall not be placed on a site accessible to those outside the working group. Public review of the draft is obtained through specific coordination or through the IEEE Sponsor ballot process. Contact an IEEE Standards staff liaison for further information.

## 5. Permissions

### 5.1 General

Information included in IEEE standards shall meet the following requirement (as noted in the permission letters in Annex D):

The IEEE requires world rights for distribution and permission to modify and reprint in future revisions and editions in all media known or hereinafter known.

In addition, no limitations on the right of the IEEE to determine appropriate business arrangements for its standards shall be included as a stipulation for use of material. Contact the IEEE Standards Activities Department by e-mail ([stds.ipr@ieee.org](mailto:stds.ipr@ieee.org)) with any questions regarding material that might not meet the requirement.

### 5.2 Excerpts of copyrighted material from other organizations

When standards developers choose to use excerpts of copyrighted text, tables, or figures and possibly modify or adapt the material to suit their needs, permission to do so shall be requested from the copyright owner. It is strongly recommended, however, that copyrighted material be referenced rather than reprinted. Standards developers are encouraged to request permission from copyright owners as soon as the decision is made to include copyrighted material in a draft. As draft documents are made available to the public, the

IEEE is required to acknowledge the ownership of any material that is not original. The following credit line shall be used in the event that specific language from the copyright holder is not available:

<Indicate material> reprinted from <copyright owner, title of publication, year of publication.>

Standards developers incorporating any previously copyrighted material into an IEEE standard shall obtain written permission from the copyright owner (see Annex D for sample permission letters), which in most cases is the publisher, prior to submittal to the IEEE-SA for Sponsor ballot. If excerpted material is inserted during ballot resolution, permission letters will be required before the recirculation ballot of the draft. The permission letters received from copyright owners shall be submitted as part of mandatory editorial coordination, along with the draft, at the start of ballot invitation or to the staff liaison prior to a recirculation if the information is included during the ballot. All permission letters will be reviewed during the mandatory editorial coordination and again when the draft is submitted to the IEEE-SA Standards Board for approval. If there are difficulties with obtaining permission responses, the working group may want to consider citing the information normatively rather than including an excerpt.

The sponsor is responsible for obtaining this permission. Any delay in obtaining the permission or agreement may result in approval conditional to receipt of permissions or it may delay publication of the standard. The sponsor is responsible for alerting the IEEE Standards Activities Department by e-mail ([stds.ipr@ieee.org](mailto:stds.ipr@ieee.org)) in instances where legal agreements or licenses are required. Working groups shall not negotiate agreements with outside entities with regard to IEEE standards. Sample letters of request and permission appear in Annex D. Please contact the IEEE Standards Activities Department ([stds.ipr@ieee.org](mailto:stds.ipr@ieee.org)) with any questions about copyright and permission.

### **5.3 Adoption of independently-developed documents as potential IEEE standards**

The submission of independently-developed documents for consideration as potential IEEE standards, for inclusion within IEEE standards, or to serve as base documents for standards development is also encouraged. In order to ensure unencumbered development from working group decisions through the consensus balloting process, standards developers shall obtain written permission release of unrestricted world rights to use a document as the basis for development of an IEEE standard and for all future revisions and editions of that standard in all media known or henceforth known and/or developed. The process of standards development may result in changes to the base document; the IEEE must maintain the right to amend the document as it sees fit to meet the needs of this process.

In some cases, as a part of the permission to use an independently-developed document as a potential IEEE standard, IEEE may need to establish a license agreement from the copyright owner allowing development and distribution of the standard. The copyright owner may also require that IEEE pay royalties or other valuable consideration on the use and distribution of the independently-developed document. The IEEE Standards Activities Department shall be alerted immediately by e-mail ([stds.ipr@ieee.org](mailto:stds.ipr@ieee.org)) so that IEEE-SA staff will have sufficient time to make necessary arrangements. Working groups shall not negotiate agreements with outside entities with regard to IEEE standards.

It is also recognized that, in giving permission to use the document as the basis for an IEEE standard, the copyright owner(s) do not forfeit the copyright to their original text and its future development outside of the IEEE; however, the copyright owner(s) must agree not to refer to their document as an IEEE standard. The copyright owner(s) will be credited for their initial development of the base document in the front matter of the approved IEEE standard. Contact the IEEE Standards Activities Department ([stds.ipr@ieee.org](mailto:stds.ipr@ieee.org)) if there is reason to believe that a license agreement might be required.

## 6. Patents

The IEEE is not responsible for identifying patents or patent applications for which a license may be required to implement an IEEE standard, or for conducting inquiries into the legal validity or scope of those patents or patent applications that are brought to its attention. However, the IEEE Standards patent policy allows for the inclusion of patented technology if the working group believes that there is technical justification to do so (see Clause 6 of the *IEEE-SA Standards Board Bylaws* [B4] and 6.3 of the *IEEE-SA Standards Board Operations Manual* [B6]). An appropriate notice statement will appear in any standard for which a patent letter of assurance (LoA) has been received at the time of publication. Public notices are contained in 6.3.1 of the *IEEE-SA Standards Board Operations Manual* [B6].

Since draft standards are made available to the public prior to approval by the IEEE-SA Standards Board, it is advisable to include the appropriate public notice. It is also necessary to request and receive an LoA from the patent holder prior to adding the “LoA received” statement to the draft. The patent holder is not obligated to provide such an assurance, but most agree to do so. If the patent holder does not agree to provide an LoA for known patents that may affect the practice of the standard, it may be necessary to include an additional notice. In any event, it is always advisable to request LoAs from patent holders as soon as possible once a decision has been reached to include the patented technology.

A Patent Letter of Assurance Request Form and additional information are available from the IEEE Standards Web site <<http://standards.ieee.org/board/pat/index.html>>.

Please note that any reference to patents or patent applications shall be made only in the front matter of the standard.

## 7. Trademarks

References to commercial equipment or products in a standard shall be generic and shall not include trademarks or other proprietary designations. Where a sole source exists for essential equipment or materials, it is permissible to supply the name of the trademark owner in a footnote. The proper use guidelines for trademarks shall be determined by the trademark owner.

All trademarks shall be credited to the trademark owner in the front matter of the standard. The following text shall be included in a footnote at any mention of specific trademark information in the standard:

This information is given for the convenience of users of this standard and does not constitute an endorsement by the IEEE of these products. Equivalent products may be used if they can be shown to lead to the same results.

Trademarks or other proprietary designations (names other than commercial equipment or products) should be avoided in standards. If used, the trademarked name shall be identified in the standard and marked as such (with either ® or ™), as appropriate, upon first reference.

Note that IEEE designations shall be identified as trademarks (® or ™, as appropriate) at first citation of each designation in the front matter and in the body of the draft.

## 8. Trial-Use standards

The IEEE-SA Standards Board allows the publication of standards documents as trial-use standards if, subsequent to publication, input from a broad constituency is needed. All trial-use standards shall be approved according to the IEEE-SA Standards Board process. The IEEE Standards project editor shall insert

the following disclaimer in each trial-use standard, replacing *<18 months from publication date>* with the trial-use comment submission deadline:

Publication of this trial-use standard for comment and criticism has been approved by the IEEE. Trial-Use standards are effective for 24 months from the date of publication. Comments for revision will be accepted for 18 months after publication. Suggestions for revision should be directed to the Secretary, IEEE-SA Standards Board, 445 Hoes Lane, Piscataway, NJ 08854, and should be received no later than *<18 months from publication date>*. It is expected that following the 24-month period, this trial-use standard, revised and balloted as necessary, shall be submitted to the IEEE-SA Standards Board for approval as a full-use standard.

## 9. Front matter

### 9.1 Title

The title should be exactly the same as that on the approved PAR, and in all cases shall reflect the scope of the standard in as few words as possible. During draft development, if the title of the draft standard changes from that listed on the PAR, the working group shall change the title of the draft standard to match that on the PAR. The changes to the title of the draft standard or the submission of the modified PAR shall be completed as soon as the title of the draft standard no longer matches the PAR.

All titles of IEEE drafts shall start with the word *Draft*, followed by

- a) “Standard [for]” when the standard specifies mandatory requirements
- b) “Recommended Practice [for]” when the standard provides recommendations
- c) “Guide [for]” when the standard furnishes information
- d) “Trial-Use (Standard, Recommended Practice, or Guide) [for]” when the document will be published for a limited period, no longer than two years, before it becomes an official IEEE document

Working groups interested in publishing ancillary materials, such as interpretations (documents issued to explain and clarify passages within a standard), should contact an IEEE Standards project editor for more information.

When an IEEE standard covers only a limited range of quantities, such as voltage, current, power, and size, the numerical limits of the ranges covered shall be included in the title. The use of nonquantitative terms (such as *high* and *low*, *large* and *small*, *wide* and *narrow*) should be avoided. Acronyms and abbreviations should be avoided in titles of standards, except in the case of units of measurement (kV, mm, etc.). However, if such use is warranted, the procedure stated in 13.6 shall be followed.

### 9.2 Abstract and keywords

The inclusion of abstracts and keywords in IEEE standards allows the documents to be referenced in a wide range of bibliographic environments, thereby increasing their utility, visibility, and availability to the public. For this reason, abstracts and keywords shall be included on the title page of each standard. Abstracts should be based on the scope and purpose of the standard as indicated on the PAR. Abstracts should also be concise and no longer than 15 lines. Keywords should highlight key terms and phrases from the text of the draft standard.

### 9.3 Introduction and committee lists

An introduction shall be supplied by the working group. It should give the history of the standard, a description of its purpose, and, if the standard is a revision, an explanation of the principal changes from the previous edition. The introduction should also explain the document structure for multipart standards, or for documents within a family of standards. An introduction is not a part of a proposed standard and shall not contain requirements or recommendations; therefore, the following statement shall appear in a box rule above the text:

[This introduction is not part of IEEE Pxxx, *title of draft.*]

At a minimum, a roster of the officers and members of the working group that developed the document shall be provided by the working group (see Figure 1). Individuals or entities that also contributed to the preparation of the document may be included in addition to the working group list (permission from entities shall be received prior to including the names in the draft).

At the time this standard was completed, the Reuse Processes Working Group had the following membership:		
<b>John Smith, <i>Chair</i></b>		
<b>Ellen Brown, <i>Vice Chair</i></b>		
Peter Armstrong	Patrick Donahue	Gregory Olive
Jessica Bradley	Bob Garnett	Thad Osterhout
Matthew Carroll	Jennifer Haase	Joseph Varady
Steve Connors	Mark Jones	Thomas Winship
	Daniel Meyers	

**Figure 1—Example of working group list**

In the working group roster, full first names are preferred over initials. Titles (Dr., Ms., P.E.) shall not be included with proper names. If entities have participated in the development of the standard, a list of the entities shall be included immediately following the working group roster.

The list of voting members of the balloting group, which is usually added by the IEEE Standards Activities Department during the publication preparation, is included in the introduction. Only the balloters (individuals or entities) who vote are listed in the standard; however, balloters may have voted for approval, disapproval, or abstention. The following paragraph shall be placed in the front matter of all IEEE drafts, above the list of voting members of the balloting group, and shall reflect the type of ballot that was conducted (individual, entity, or mixed):

The following members of the <individual/entity> balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

If footnotes are necessary in an introduction, they shall be noted with lowercase letters (a, b, c, d, etc.).

### 9.4 Acknowledgments

In the past, some sponsors have included special acknowledgments in the front matter of their published standards. Permission shall be requested from the Manager, Standards Editing and Production before including such acknowledgments in the draft.

## 9.5 Table of contents

A table of contents listing the main clauses (identified by one digit) and the first series of subclauses under each clause (identified by two digits) should be supplied. The next series of subclauses (identified by three digits) may be included when deemed appropriate by the IEEE Standards project editor and the working group. If included, the table of contents shall be generated automatically, and not composed manually. Lists of tables and figures should not be included in the table of contents. Only the appropriate clauses, subclauses, and normative and/or informative annexes should be listed. (See Annex B for a sample table of contents.) All titles in the table of contents should be concise, and may be abbreviated versions of the titles within the document. It should be noted that tools for automatic generation within the table of contents may not support titles longer than one line.

## 10. Document structure

### 10.1 Normative and informative clauses

*Normative* text means information that is required to implement the standard and is therefore officially part of the standard. *Informative* text is provided for information only and is therefore not officially part of the standard.

The draft standard shall contain normative text in the main clauses of the document, including footnotes to tables (see 15.5), and in normative annexes. Informative text shall be placed in notes (to text, tables, and figures), in footnotes within text, and in informative annexes. Interspersed normative and informative text is not allowed. As such, neither clauses nor subclauses shall be labeled as informative. Identification of normative or informative text shall be reviewed during the ballot of a document; therefore, it is important that the working group consult an IEEE Standards project editor early with any questions.

### 10.2 Order of clauses

The first clause of a standard shall always be an overview (except for amendments and corrigenda, which do not usually have an overview, scope, or purpose). If the standard contains references and definitions, they shall be Clause 2 and Clause 3, respectively. The clauses that follow Clause 2 and Clause 3 can be ordered in any way by the working group. If clause and subclause titles begin with numbers, they should be spelled out, unless unavoidable (e.g., 10BASE-T).

### 10.3 Overview

#### 10.3.1 Structure of the overview

The overview shall be a succinct description of the scope of the standard and may include, if necessary, the purpose, applications, and other areas that the working group considers relevant. These optional topics may be presented as separate subclauses of the overview. If these separate subclauses are presented, a minimum of two subclauses are required.

This clause shall be entitled *Overview* unless it contains only a scope; in this case, the clause shall be entitled *Scope* without any further subdivision. The overview shall not contain detailed discussions of the general technical content of the standard. If the standard contains annexes, these should be described in the overview.

### 10.3.2 Scope

The scope of the standard shall explain in statements of fact what is covered in the standard and, if necessary, what is not covered in the standard. In other words, the technical boundaries of the document shall be discussed. The scope should be succinct so that it can be abstracted for bibliographic purposes.

For new and revision projects, the scope of the draft standard submitted for ballot shall match the scope of the approved PAR.

For amendments and corrigenda, there is normally no scope in the draft document. Therefore, on the PAR form, the scope shall state what the amendment/corrigendum is changing.

Regardless of project type, during draft development, if the scope of the draft standard deviates from the scope of the PAR, the working group shall modify either the draft standard to bring it into compliance with the scope of the PAR or revise the PAR so that the two match. If it is discovered by IEEE-SA editorial staff during the MEC review of the draft standard that the scopes do not match and the scope of the draft document is to remain as-is, the draft standard can proceed to ballot; however, the WG should notify the ballot group that the scope of the draft standard does not match that of the PAR and, in addition, shall submit a modified PAR to NesCom for approval by the IEEE-SA Standards Board.

Please note the distinction from the purpose of the standard discussed in 10.3.3.

### 10.3.3 Purpose

A paragraph describing the purpose is not mandatory in the draft standard. However, if included, the purpose of the standard and its intended application shall be included in a separate subclause. The purpose shall explain *why* the standards project is needed.

For new and revision projects, the purpose (if included) of the draft standard submitted for ballot shall match the purpose of the approved PAR.

For amendments and corrigenda, there is normally no purpose in the draft standard. Therefore, on the PAR form, the purpose shall state why the changes are being made.

Regardless of project type, if during MEC of the draft, IEEE-SA editorial staff discovers that the purposes do not match and the purpose of the draft document is to remain as-is, the draft standard can proceed to ballot; however, the WG shall notify the ballot group that the purpose of the draft standard does not match that of the PAR and, in addition, shall submit a modified PAR to NesCom for approval by the IEEE-SA Standards Board.

Please note the distinction from the scope of the standard discussed in 10.3.2.

## 10.4 Normative references

### 10.4.1 Citation as a normative reference

Normative references are those documents that contain material that must be understood and used to implement the standard. Thus, referenced documents are indispensable when applying the standard. Each normative reference shall be cited, and the role and relationship of each referenced document shall be explained in the body of the standard. If a reference is not specifically cited in the normative text of the document, then it shall not be listed in the normative references clause. In such cases, it shall be listed in the first or final informative annex, entitled Bibliography [see item h) below].

The following guidelines shall be followed when creating the normative references clause:

- a) The balloting group shall approve the contents of the normative references clause during the ballot of the standard.
- b) In an amendment, when inserting an introductory paragraph into the normative references clause, developers should take special care in determining whether the intent of the base standard is maintained in the amendment.
- c) IEEE and other nationally or internationally recognized standards developing organizations (SDOs) are to be preferred as the source of normative references. Documents published by other organizations may be cited provided that the following is true:
  - The document is judged by the balloting group to have wide acceptance and authoritative status.
  - The document is publicly available at reasonable cost.
- d) Dated and/or undated references are allowed in standards. Using undated references helps eliminate the burden of continuous updates to align standards as they are revised, while ensuring that the most up-to-date information on technologies and statutes is referenced (when appropriate). Dated references can be used in certain circumstances, such as when a high degree of specificity is needed. The responsibility of determining whether a reference should be dated or undated lies with the working and balloting groups, who shall determine what is best during implementation of a given standard, and therefore what is best for the standard's user.
- e) References to specific clauses or subclauses, tables, and figures of another document shall be dated.
- f) Using documents that are not standards presents the problem that they might be revised without notice in a manner that might adversely affect any standard that lists them as normative references. Documents that are cited as normative references, but that are developed by organizations that are not nationally or internationally recognized SDOs, shall include the edition or date of publication in the citation.
- g) If the standard is intended for international adoption, the working group should take into consideration requirements for normative references by international organizations, such as the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). These requirements may include procedures for justification of normative references that are not international standards. Please contact an IEEE Standards project editor for information about specific requirements.
- h) Documents to which reference is made only for information or background, and documents that served merely as references in the preparation of the standard are not normative references. Such documents may, however, be included in a bibliography. (See Clause 19 for the format of bibliographic entries.)
- i) Reference to withdrawn standards may be made; however, Sponsors are cautioned that withdrawn standards may contain obsolete or erroneous information and may be difficult to retrieve.
- j) Sponsors shall not use unpublished draft standards as normative references unless they are dated, readily available, and retrievable. If an IEEE draft is cited, the sponsor shall provide a copy of the draft to be placed on file in the IEEE Standards Activities Department. Please consult with an IEEE Standards project editor if such inclusion is necessary. If the IEEE draft that is referenced is approved prior to the publication of the document, the draft reference will be updated to reflect this change by the IEEE Standards project editor as part of the publication process. If the working group prefers that the draft reference remain as is, the citation has to be followed by "(this version)."

### 10.4.2 Structure of the normative reference clause

The following guidelines shall be followed when structuring the normative references clause:

- a) The normative reference clause is introduced with the following paragraph:

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

- b) The IEEE Standards project editor will list the information (i.e., title) for the most current edition of the undated material cited. In some cases, the most current edition is not the one required. It is also important for the sponsor to remember that the dated edition listed in the balloted document will be the one that appears in the published document. Therefore, it is the responsibility of the sponsor to not only determine which edition of a document is applicable in each case, but also to ensure that the balloted document lists the correct edition.
- c) The sponsor shall endeavor to supply complete and current information for normative references. Note that IEEE Standards project editors cannot verify that normative references to updated editions of documents (i.e., undated references) are accurate; therefore, it is up to the sponsor to consult the latest editions to see if they still apply.

### 10.4.3 Style for reference entries

Normative references shall be listed in alphanumeric order by designation, including the full title. Documents that are not standards, and that are cited as normative references, shall include the edition or date of publication in the citation. A footnote should be inserted in the text after the first cited normative reference in order to tell the reader where the references are listed. (See 1.1 of Annex B for an example of this type of footnote.)

*Example:*

## 2. Normative references

The following referenced documents are indispensable for the application of this standard (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

Accredited Standards Committee C2-2007, National Electrical Safety Code® (NESC®).

ATIS T1.602-1996, Telecommunications—Integrated Services Digital Network (ISDN)—Data-Link Layer Signalling Specification for Application at the User-Network Interface.

IEEE P802b™ (Draft 3, 21 November 2003), Draft Standard for Local and Metropolitan Area Networks—Overview and Architecture—Amendment 2: Registration of Object Identifiers.

IEEE Std 1048™, IEEE Guide for Protective Grounding of Power Lines.

IEEE Std C37.04a™-2003, IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis—Amendment 1: Capacitance Current Switching.

ISO/IEC 7498-4, Information processing systems—Open Systems Interconnection—Basic Reference Model—Part 4: Management framework.

ISO/IEC 9945-1:2003, Information technology—Portable Operating System Interface (POSIX®)—Part 1: Base Definitions.

ISO/IEC FDIS 15444-6 (27 February 2003), Information technology—JPEG 2000 Image Coding System—Part 6: Compound Image File Format.

ITU-T Recommendation Z.100, Formal Description Techniques (FDT)—Specification and description language (SDL).

NFPA 70, 2005 Edition, National Electrical Code® (NEC®).

In the preceding example, note that IEEE Standards style is shown for joint standards and draft standards from several organizations. Note that draft standards are placed in the appropriate alphanumeric order (anticipating their location upon final approval).

References should be cited by designation (e.g., IEEE Std 1226.6™ or IEEE Std 1625™-2004) in the text, in tables, in figures, or in notes at the point where the reference applies. Note that IEEE designations shall be identified as trademarks (® or ™, as appropriate) at first citation of each designation in the front matter and in the body of the draft.

#### 10.4.4 Internet citations

When citing information found on the Internet, the following format should be used where “<entity>” is replaced with the name of an organization and <URL> is replaced by the Internet location:

“... is available from the <entity> Web site <URL>.”

“(see the information at the following Internet location: <URL>).”

The URL should be the most stable location whenever possible to avoid inadvertent or intentional changes that would affect the site name, i.e., you would use the index to the page rather than the page itself.

Any information that is cited normatively in the standard shall be made available from the IEEE Standards Web site, or should exist on an established SDO site. The working group shall obtain permission where needed. The IEEE Standards Activities Department should be contacted by e-mail (stds.ipr@ieee.org) in instances where legal agreements are required (see Clause 5).

If a document listed in a bibliography or normative reference is accessed from the Internet, the document title, date, version, or other pertinent information should be listed, followed by a footnote that gives the Internet location. If the document needs to be on the IEEE Standards Web site, the working group can insert the following placeholder until the site location is assigned:

“This document is available from the IEEE Standards Web site <insert IEEE Internet location>.”

Contact an IEEE Standards project editor with any questions about documents that should be placed on the IEEE Standards Web site.

### 10.5 Definitions

#### 10.5.1 General terminology usage

English words should be used in accordance with their definitions in the latest edition of *Webster's New Collegiate Dictionary* [B11]. Electrical and electronics terms not defined in *Webster's New Collegiate Dictionary* [B11] should be used in accordance with their definitions in the most recent edition of *The Authoritative Dictionary of IEEE Standards Terms* [B7]. Working groups are strongly encouraged to use

definitions that already exist in *The Authoritative Dictionary* [B7] instead of creating new definitions or slightly modifying existing definitions.

Working groups shall not incorporate into the definitions clause terms that were already published in *The Authoritative Dictionary* [B7]. However, if the working group feels that including such terms is necessary for effective use of the document, the terms may be placed in an informative annex, entitled Glossary. During mandatory ballot coordination of definitions and terms by SCC10, working groups may be asked to validate the use of terms that already exist, or terms that vary slightly from those that already exist in *The Authoritative Dictionary* [B7]. If the definitions in *The Authoritative Dictionary* [B7] do not reflect usage specific to the document, or if terms used are not defined in *The Authoritative Dictionary* [B7], then appropriate definitions shall be provided. Users are also encouraged to use the *IEC Multilingual Dictionary of Electricity, Electronics, and Telecommunications* [B2], and the *IEC International Electrotechnical Vocabulary (IEV)* [B3].

### 10.5.2 Construction of the definitions clause

A definitions clause, typically Clause 3 (unless the standard does not contain references), is provided for those not already familiar with the terminology in question. Definitions should appear in alphabetical order and the term defined should be written out completely and should not be inverted (e.g., use “drift rate” rather than “rate, drift”). Each term should be numbered as a subclause of the definitions clause. Each definition should be a brief, self-contained description of the term in question and shall not contain any other information, such as requirements and elaborative text. The term should not be used in its own definition.

All terms defined in IEEE standards are incorporated into *The Authoritative Dictionary* [B7]. For this reason, it is important that terms and definitions have as general an application as possible. Definitions should not include references to other parts of the standard. An explanatory note may be provided to refer the user to another part of the standard. Terms defined in other standards may be used in IEEE standards as long as they are properly cited. After the definition, the source shall be cited in parentheses. It is the sponsor’s responsibility to obtain the appropriate permissions if a standard uses a term from another source (see 5.2).

The term defined should appear after the number. The definition should follow as a sentence preceded by a colon. Subdefinitions of a term should be marked as (A), (B), etc. Cross-references should occur after the definition and may consist of the following classes, in the order shown: *Contrast.*, *Syn.*, *See.*, and *See also*: *Contrast.* refers to a term with an opposite or substantially different meaning. *Syn.* refers to a synonymous term. *See.* refers to a term where the desired definition can be found. *See also*: refers to a related term. The cross-references listed under these headings should be in alphabetical order, in bold type, and separated by semicolons when there are more than one.

The following is an example of a correctly styled definitions clause:

For the purposes of this document, the following terms and definitions apply. The glossary in Annex C and *The Authoritative Dictionary of IEEE Standards Terms*, [B7] should be referenced for terms not defined in this clause.

**3.1 acceleration-insensitive drift rate:** The component of systematic drift rate that has no correlation with acceleration. *See also:* **drift rate; systematic drift rate.**

**3.2 code set:** *See:* **coded character set.**

**3.3 coded character set:** A set of characters for which coded representation exist. *Syn:* **code set.**

**3.4 drift rate:** The slope at a stated time of the smoothed curve of tube voltage drop with time at constant operating conditions. (adapted from IEC 12345: 2006)

**3.5 input reference axis (IRA):** The direction of an axis as defined by the case mounting surfaces, external case markings, or both. *Contrast:* **output reference axis.**

NOTE—See 6.7.

**3.6 output:** (A) Data that has been processed. (B) The process of transferring data from an internal storage device to an external storage device.

**3.7 systematic drift rate:** That component of drift rate that is correlated with specific operating conditions.

## 10.6 Acronyms and abbreviations

This subclause applies to acronyms and abbreviations only. The treatment of letter symbols for units (e.g., mm for millimeter), letter symbols for quantities (e.g., R for resistance), and mathematical symbols (e.g., log for logarithm) is covered in IEEE Std 260.1 and IEEE Std 280 (see also Clause 14).

If the standard makes extensive use of acronyms or abbreviations, a subclause within the definitions clause may be provided. If acronyms and abbreviations are included in the definitions clause, the clause title should be “Definitions, acronyms, and abbreviations.” Subclauses 3.1 and 3.2 would be titled “Definitions” and “Acronyms and abbreviations,” respectively.

The acronyms and abbreviations subclause is not meant to take the place of the definitions clause. If a definition is needed, the term should be added to the definitions clause as well. Acronyms and abbreviations, followed by the full term only, should be listed in alphanumeric order.

Example:

DER	distributed emission regeneration
DIS	distributed interactive simulation
ISDN	integrated services digital network
ISO	International Organization for Standardization
LAN	local area network
PDU	protocol data unit

For information on the use of acronyms and abbreviations in text, see 13.6.

## 10.7 Annexes

### 10.7.1 Order

Normative and informative annexes shall be referred to as such [e.g., Annex A (normative), Annex B (informative)] in their titles and in the table of contents. Annexes should be referenced in the text by the word *Annex* and its letter only (e.g., “see Annex A”). Annexes should appear in the order in which they are referenced in the body of the standard (e.g., the first annex mentioned should be Annex A, the second Annex B, and so on). Note that this rule means that normative and informative annexes will be intermixed. An exception to this rule is the bibliography. The bibliography should be either the first or last annex of the standard (in instances where an index exists, all annexes would precede the index). If a glossary exists, it should either be the last annex or it should immediately precede the bibliography (if the bibliography is the last annex).

### 10.7.2 Normative

Normative annexes are official parts of the standard that are placed after the body of the standard for reasons of convenience or to create a hierarchical distinction. In many cases, normative annexes are used for conformance test procedures or tables. Some standards place syntax definitions, lists of keywords, or printed source code in normative annexes. Normative annexes may also be used for context-specific applications of the standard.

### 10.7.3 Informative

Informative annexes are included in a standard for information only and are not an official part of the standard itself. Standards writers should carefully consider the nature of the material placed in informative annexes. The working group should also understand that informative annex material is considered part of the balloted document and copyrighted to the IEEE. As such, it shall be submitted to the IEEE-SA Standards Board and is not subject to change after approval.

An example of an informative annex is a bibliography (see Clause 19 for information about bibliographic style).

## 10.8 Index

Indexes are discouraged unless the document is very long or complicated. However, the working group may include an index in a draft standard when it is deemed necessary or helpful to the reader. Since most indexes are generated electronically, it is important to consult with an IEEE Standards project editor before setting up index tags in an electronic file to ensure that the index tags can be maintained and updated for publication. The IEEE Standards Activities Department cannot guarantee that an index created for a draft standard will be published when the standard is approved; the quality of the index, its usefulness, and whether it can be properly updated or not will be factors in the decision of the IEEE Standards Activities Department whether to use it. (Note that preparing an index will add time to the publication schedule.) Working groups interested in including an index should consult *The Chicago Manual of Style* [B1] or another reliable source on index preparation.

*Example:*

albatross, 15–23  
antenna, 34, 64, 93  
axiom, 45, 103

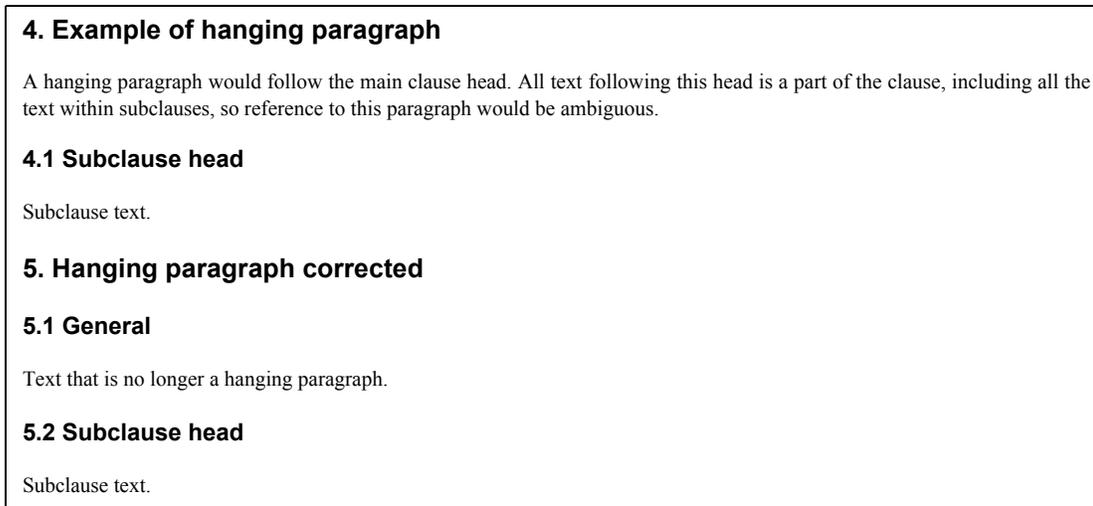
## 11. Numbering in text

### 11.1 Body clauses

The body of a standard is usually divided into several major clauses that are further divided into subclauses. The IEEE Standards system for numbering clauses uses Arabic numerals in sequence. A subclause should be numbered by adding a decimal point and number to the clause number (e.g., 5.1). Subclauses may be divided into further subclauses by adding a second decimal point and number (e.g., 5.1.1). Five numbers separated by decimal points is the maximum acceptable subdivision (e.g., 5.1.1.1.1). If necessary, the material should be reorganized to avoid subdivisions beyond this point. An exception to this numbering is allowed for amendments (see 21.2 for information on numbering in amendments and corrigenda).

Clauses and subclauses should be divided into further subclauses only when there is to be more than one subclause. In other words, clauses and subclauses should not be broken down into further subclauses if another subclause of the same level does not exist. For example, Clause 1 should not have a subclause 1.1 unless there is also a subclause 1.2.

All clause and subclause headings should consist of a number and a concise title. The text follows immediately after the subclause title on a new line. Hanging paragraphs (i.e., paragraphs following a main clause head or main subhead) should not be used since reference to the text would be ambiguous. It may be necessary to include a subhead with the title “General” to avoid instances of hanging paragraphs, as shown in Figure 2.



**Figure 2—Hanging paragraphs**

The terms *clause* or *subclause* should not be used in headings or references except when referring to major clause headings (e.g., “see Clause 5”) or at the beginning of a sentence. All other cross-references should be made by simply referring to the number (e.g., “see 5.1”).

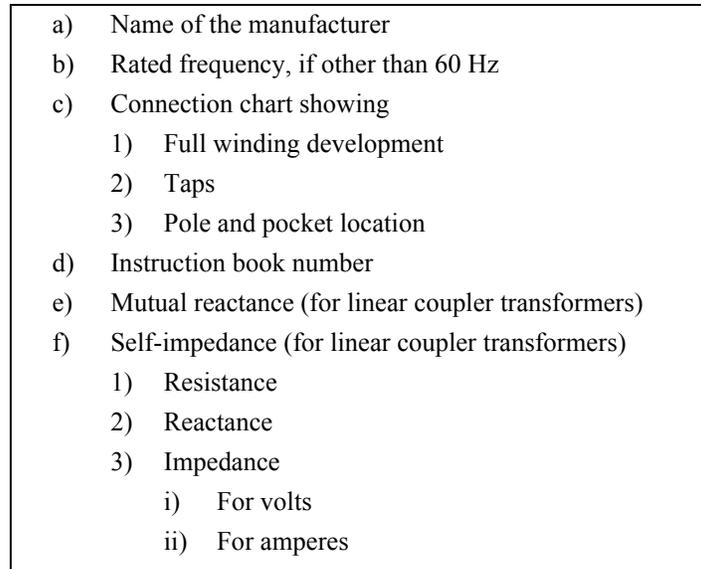
Standards are not published with line numbers (although numbers may be included in balloted drafts). Therefore, the working group should use only clause or subclause numbers in cross-references.

## 11.2 Annexes

Consecutive capital letters and a title should be used to identify each annex. Text should be organized and numbered as described in 11.1, with the following exception: clause and subclause numbers should be prefaced with the identifying letter of the annex, followed by a period (see the example annex in Annex B). For standards containing only one annex, the letter *A* should appear in its title and should preface the clause and subclause numbers in the text. Figures and tables included in annexes should also carry the identifying letter of the annex in which they appear, followed by a period. For example, the first figure in Annex A should be identified as Figure A.1.

## 11.3 Lists

Lists in a subclause may be ordered or unordered. An ordered list of items within a subclause should be presented in outline form, with items lettered a), b), c), etc. If a further subdivision of the items is necessary, 1), 2), 3); i), ii), iii); dashed subdivision items, etc., should be used to form a tiered list. Only one ordered list may be presented in any subclause to avoid confusing cross-references. Dashed lists can be used instead of an ordered list, where applicable. Closing punctuation should be omitted in lists of short items or phrases. Punctuation should be used for sentences. Figure 1 provides examples of the different levels in an ordered list. Clause 22 contains some examples of dashed lists.

- 
- a) Name of the manufacturer
  - b) Rated frequency, if other than 60 Hz
  - c) Connection chart showing
    - 1) Full winding development
    - 2) Taps
    - 3) Pole and pocket location
  - d) Instruction book number
  - e) Mutual reactance (for linear coupler transformers)
  - f) Self-impedance (for linear coupler transformers)
    - 1) Resistance
    - 2) Reactance
    - 3) Impedance
      - i) For volts
      - ii) For amperes

**Figure 1—Example of a tiered list**

## 11.4 Exceptions

If standards developers have a valid reason for wishing to diverge from the organization and numbering system described in this clause, they should consult with an IEEE Standards project editor as early as possible in the project's development.

## 12. Homogeneity

Uniformity of structure, of style, and of terminology should be maintained not only within each standard, but also within a series of associated standards. The structure of associated standards and the numbering of their clauses should be identical, as far as possible. Analogous wording should be used to express analogous provisions; identical wording should be used to express identical provisions.

The same term should be used throughout each standard or series of standards to designate a given concept. The use of an alternative term (synonym) for a concept already defined should be avoided. As far as possible, only one meaning should be attributed to each term used.

## 13. Word usage

### 13.1 *Shall, should, may, and can*

The word *shall* is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*). The use of the word *must* is deprecated and shall not be used when stating mandatory requirements; *must* is used only to describe unavoidable situations. The use of the word *will* is deprecated and shall not be used when stating mandatory requirements; *will* is only used in statements of fact.

The word *should* is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not

necessarily required; or that (in the negative form) a certain course of action is deprecated but not prohibited (*should equals is recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may equals is permitted to*).

The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can equals is able to*).

### 13.2 *That and which*

The words *that* and *which* are commonly misused; they are not interchangeable. *That* is best reserved in essential (or restrictive) clauses; *which* is appropriate in nonessential (or nonrestrictive), parenthetical clauses. Simply stated, if a comma can be inserted before the word *that* or *which*, the word should be *which*. If a comma would not be used, the word to use is *that*.

*Example:*

- a) Defining the inputs and outputs provides a better understanding of the steps *that* are necessary to complete the process.
- b) Defining the inputs and outputs provides a better understanding of these steps, *which* are explained in 5.1 through 5.9.

### 13.3 Gender-Neutral language

In order to reflect the changing practices in language usage, the IEEE Standards Activities Department uses, in as many cases as possible, generic titles (such as *chair* rather than *chairman*) in the body of the standard. The following practices shall apply:

- a) When writing in the third person, the phrase *he or she* should be used. The male or female pronoun alone or the variations *he/she* or *s/he* should not be used. Also, the pronoun *they* should not be used as a singular pronoun.
- b) If a particular sentence becomes cumbersome when *he or she* is used, the sentence should be rewritten in the plural or completely rewritten to avoid using pronouns. The indefinite pronoun *one* should be avoided. In references to a company, the pronoun *it*, not *we* or *they*, should be used.

### 13.4 Use of the terms *safe* or *safety*

Generally, it is preferable to avoid the use of the word *safe* in a standard unless the condition or practice referenced by the word *safe* has been tested under all cases as being, in fact, *safe*. Typically, this is not the case. Thus, unless it can be demonstrated that such condition or practice is *safe*, it should not be used. Words such as *safer* or *safest* can be used in a relative context if it can be demonstrated to be the case. For example, it is proper to say that one set of conditions or practices is *safer* than another, if in fact true, or that it is *safer* to employ a certain practice than not in a given situation. However, the term *safest* implies an absolute condition, which, in certain contexts, has the same implication as *safe* and, thus, should not be used. For example, *this is the safest set of conditions for using waveguide* is an improper usage.

The word *safety* should be avoided if it is being used to address a set of conditions or practices that have not been established for the purpose of promoting safety under all situations in which such conditions or practices will be employed. For example, *the following 10 safety considerations should be reviewed before implementing this practice* should not be used.

### 13.5 Use of the first- or second-person forms of address

The first-person form of address (*I, we*) or the second-person form of address (*you*) should not be used or implied in standards, e.g., “*You should avoid working on lines from which a shock or slip will tend to bring your body toward exposed wires.*” This sentence should be rewritten to identify the addressee, as follows: “*Employees should avoid working on lines from which a shock or slip will tend to bring their bodies toward exposed wires.*”

### 13.6 Abbreviations and acronyms

Technical abbreviations and acronyms should be used to save time and space, but only if their meaning is unquestionably clear to the reader. The first use should be spelled out, followed by the abbreviation or acronym itself in parentheses. Exceptions to this are approved SI units. A list of abbreviations and acronyms may be included as a separate clause, if necessary (see 10.6). SI unit symbols are not abbreviations and shall not be included in a list of abbreviations and acronyms.

Abbreviations and acronyms should be avoided in titles of standards. However, if such use is warranted, the procedure stated in the previous paragraph should be followed.

### 13.7 Hyphenation

In most cases, compound adjectives (such as *fiber-optic* cable, *lead-acid* batteries, *power-operated* valve assemblies) should be hyphenated. IEEE Standards project editors check documents for consistency of hyphenation; when the working group has a decided preference (such as *life cycle* process), that preference will be enforced. The use of hyphenated multiple adjectives (such as *compressed-air-actuated* power tools) should be limited to cases where such use is necessary to ensure comprehension.

### 13.8 Capitalization

The initial letter of the first word should be capitalized in

- Clause, subclause, and annex headings
- Specific cross-references in text [e.g., Table 1, Figure 12, NOTE 2, Equation (3)]
- Titles for figures
- Titles for tables
- Column and line headings in tables (see Table 2)
- Lettered and numbered list entries

### 13.9 Using standard designations in text

When using standard designations in text, two simple rules apply:

- a) When referring to the document, i.e., the standard that is published, *IEEE Std 1234* should be used. For example, “*IEEE Std 1234 should be referenced for more information on protocol layering.*”
- b) When referring to the technology that the document standardizes, *IEEE 1234* should be used. For example, “*IEEE 1234 protocol layering is employed in the previous example.*”

## 14. Quantities, units, and letter symbols

### 14.1 General

The word *quantity* has many meanings; in this clause the word refers to physical quantities, which are measurable attributes such as length, mass, time, and temperature. A unit is a particular sample of a quantity, chosen so that an appropriate value may be specified. Meter, kilogram, hour, and degree Celsius are some of the units used for the four quantities noted previously. The value of a quantity is generally expressed as the product of a number and a unit. Quantities and units may be represented in text by letter symbols, and are always so represented in equations.

### 14.2 Numbers

The following rules should be observed:

- a) The decimal marker should be a dot on the line (decimal point). This applies even when the standard in question is intended for international adoption (e.g., adoption by ISO/IEC), see Clause 22.
- b) For numbers of magnitude less than one, a zero should be placed in front of the decimal point (see 15.4.2).
- c) In general text, isolated numbers less than 10 should be spelled out. However, in equations, tables, figures, and other display elements, Arabic numerals should be used. Numbers applicable to the same category should be treated alike throughout a paragraph; numerals should not be used in some cases and words in others.
- d) The value of a quantity shall be expressed by an Arabic numeral followed by a space and the appropriate unit name or symbol. An upright (Roman) type font should be used for the unit symbol even if the surrounding text uses a sloping (italic) font.
- e) If tolerances are provided, the unit shall be given with both the basic value and the tolerance (150 m  $\pm$  5 mm). Ranges should repeat the unit (e.g., 115 V to 125 V). Dashes should never be used because they can be misconstrued for subtraction signs.

### 14.3 Metric system

In 1995, the IEEE implemented a metric policy (IEEE Policy 9.19) that calls for measured and calculated values of quantities to be expressed in metric units [SI (Système International d'Unités)] in IEEE publications. (See IEEE/ASTM SI 10 for guidance on metric practice.) The IEEE-SA Standards Board Implementation Plan for the IEEE metric policy states that proposed new standards and revised standards submitted for approval should use metric units exclusively in the normative portions of the standard. Inch-pound data may be included in parentheses after the metric unit if the sponsor believes that the audience for this document would benefit from the inclusion of inch-pound data, based on concerns for safety or clarity. Metric units shall always be the primary unit of measurement.

IEEE Policy 9.19 recognizes the need for some exceptions and contains the following statement: "Necessary exceptions to this policy, such as where a conflicting world industry practice exists, must be evaluated on an individual basis and approved by the responsible major board of the Institute for a specific period of time." Standards Coordinating Committee 14, as part of the coordination process, shall review requests for individual exceptions, including those noted below, and shall report its recommendations to the IEEE-SA Standards Board.

#### *Exceptions:*

- a) A specific exception is given for trade sizes, such as the AWG wire series and inch-based standards for fasteners. Such data need not be translated into metric terms.

- b) Also excepted are those cases, such as plugs and sockets, where a mechanical fit to an inch-based product is required.
- c) This Implementation Plan does not require metric products to be substituted for inch-based products.

For further information, see IEEE/ASTM SI 10, IEEE Std 260.1, and IEEE Std 270.

## 14.4 Letter symbols

In IEEE standards, letter symbols should be used rather than abbreviations. Letter symbols include symbols for physical quantities (quantity symbols) and symbols for the units in which those quantities are measured (unit symbols). Unlike common abbreviations, letter symbols are invariant in singular and plural, they are not followed by a period, and case is maintained independent of the surrounding text (see IEEE Std 260.1).

For example, standard quantity symbols for length, mass, and time are *l*, *m*, *t*. They are set in italic letters. Unit symbols for the same four quantities are m, kg, s and °C, set in Roman (upright) letters. Note especially that V is the symbol for the unit “volt,” and *V* (italic) is the symbol for the quantity “voltage.” Unit symbols may not be used to stand for the quantity being measured; that is, do not write

- “The km between the substations is 20,” but write instead, “The distance between the substations is 20 km.”
- “The amperes that flow into the ground,” but write instead, “The current that flows into the ground.”
- “Polarity shall be additive for all kVA transformers rated at 200,” but write instead, “Polarity shall be additive for all transformers with an apparent power rating of 200 kVA.”

## 15. Tables

### 15.1 Nomenclature

Tables provide a clear and concise way of presenting large amounts of data in a small space. Table 2 shows the nomenclature used for the parts of a table, and Table 3 provides a substantive example that can be used as a model.

**Table 2—Nomenclature for the parts of a table**

Column heading	Column heading	Column heading	
		Column subheading	Column subheading
Line heading Subheading Subheading	Tabulated data (individual positions within the body of the table are called <i>cells</i> )		
Line heading			

### 15.2 Labeling and presentation of tables

Except for informal tables (see 15.6), tables should be given a number and a concise title and should be cited in the text with the word *Table* followed by the number. (See 15.3 for information on the numbering of tables.) Tables should be boxed and ruled, as shown in Table 2 and Table 3.<sup>8</sup> Whenever possible, tables should be organized to fit on a single page. When a table must carry over for more than one page, complete column headings should be repeated at the top of successive pages. The table number and title should be repeated at the top of the page as follows: “Table 1—Title (*continued*).”

<sup>8</sup>Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement the standard.

**Table 3—A substantive example of table format**

Type of source(s)	Type of calculation					
	First cycle		Interrupting		Medium-voltage circuit breaker close and latch <sup>a</sup>	
	Rate multiplier	Winding multiplier (See NOTE 2)	Rate multiplier	Winding multiplier (See NOTE 2)	Rate multiplier	Winding multiplier (See NOTE 2)
Induction motors Above 75 kW at 1800 r/min	1.0	1.0	0.667	1.5	1.000	1.0
Above 190 kW at 3600 r/min	1.0	1.0	0.667	1.6	1.000	1.0
All others 37 kW and above	1.0	1.0	0.333	3.0	0.833	1.2
All smaller than 37 kW	1.0	1.0	NEGLECT	NEGLECT	—	—
NOTE 1—This table is provided as an example. The structure of actual tables may vary depending on the data being displayed.						
NOTE 2—Use 0.75 <i>X<sub>d</sub></i> for hydrogenerators without amortisseur windings.						

<sup>a</sup>Refers to calculations for medium-voltage circuit breakers.  
Adapted with permission from *Electrical Transmission and Distribution Reference Book*, East Pittsburgh, PA: Westinghouse Electric Corporation, 1964.

### 15.3 Numbering and capitalization

Tables should be numbered consecutively in a separate series and in the order of their reference in the text (e.g., Table 1, Table 2, Table 3). Hyphenated numbers should not be used except in standards of considerable length. In the latter case, it is appropriate to label the first table in a clause with the number 1, preceded by the clause number (e.g., Table 6-1, Table 6-2).

Tables included in annexes should also carry the identifying letter of the annex in which they appear, followed by a period. For example, the first table in Annex A should be identified as Table A.1.

Tables should be referenced in the text by the word *Table* and their number only (e.g., “see Table 1”). If referring to two or more tables in the same sentence, each should be named separately. For example, use “see Table 1, Table 2, and Table 3,” instead of “see Tables 1 through 3.”

Only the initial letter of the first word and proper nouns should be capitalized in

- Table titles
- Column and line headings in tables (see Table 2)

NOTE—See 16.2 for information on the numbering of figures.

### 15.4 Presentation of data and table format

#### 15.4.1 Units of measure

Units of measure shall always be provided either in the title, in parentheses or preceded by a solidus in the column headings [e.g., for volts either *E* (V) or *E* / V would be acceptable], or in a NOTE. The same units of measure shall be used throughout each column; ohms shall not be combined with megohms, millimeters with centimeters, or seconds with minutes. To save space, abbreviations and letter symbols should be used in column and line headings wherever possible. (See IEEE Std 260.1 and other standards in Clause 2 for the appropriate abbreviations and symbols for use in standards.)

### 15.4.2 Numerical values

To facilitate the comprehension of numbers, digits should be separated into groups of three, counting from the decimal point toward the left and right. The groups should be separated by a space, rather than by a comma, period, or dash. If the magnitude of the number is less than one, the decimal point should be preceded by a zero. In numbers of four digits, the space is not necessary, unless four-digit numbers are grouped in a column with numbers of five digits or more.

*Examples:*

73 722            7372            0.133 47

All numbers should be aligned at the decimal point. The width of the columns may vary to accommodate the length of the longest entry in each column. Only as many significant digits should be used as the precision of data justifies. Decimal fractions should be used in tabulations unless fractions are commonly used in the field.

Common fractions and decimal fractions shall not be combined in the same table. A dash should be used to indicate the lack of data for a particular cell in a table.

### 15.5 Notes and footnotes to tables

A note to a table is not an official part of the standard and should immediately follow the table to which it belongs. If the text is mandatory, it should appear in the body of the standard or in a footnote to the table. Important information on safety, health, or the environment shall not be included in notes to tables. Notes to a table should appear before any table footnotes in the following order:

- a) *General notes.* General notes apply to the entire table and should be introduced by “NOTE—” set in upright capital letters. Multiple notes in sequence should be numbered “NOTE 1—”, “NOTE 2—”, etc.
- b) *Crediting source.* Use either of the following credit lines:
  - 1) Reprinted with permission from... (Use when data is derived from another source from which permission to reproduce has been obtained.)
  - 2) Source: (Use when data is derived from another IEEE standard.)
- c) *Notes on specific parts of the table.* Specific notes should be introduced by “NOTE—” set in upright capital letters. Multiple notes in sequence should be numbered “NOTE 1—”, “NOTE 2—”, etc., or continue the numbering of the general notes.

Footnotes to tables may contain normative information. They should be marked with lowercase letters starting with “a” for each table.

NOTE 1—See Table 3 for examples of these notes.

NOTE 2—See Clause 18 for information on the style for notes.

### 15.6 Informal tables

Simple tabulations that are not referred to outside of the subclause in which they appear may be organized into informal tables that do not exceed five or six lines in depth; no table number or title is required. However, it is recommended that all tables be numbered and titled if possible.

*Example:*

Cable type	Rated voltage (kV)
High pressure	69–161
Low pressure gas-filled	10–29 30–46
Low and medium pressure liquid-filled	15–161 230

Working groups shall obtain permission to use any table from another source, including from a manufacturer, preferably prior to using it in a draft standard (see 4.1 and Clause 5).

## 16. Figures

### 16.1 Creating figures

Figures appropriate for use in IEEE standards may be black and white graphs, charts, schematic drawings, or photographs. Most working groups now prepare figures in electronic form by using a drawing program or scanner to capture printed material. It is important to keep in mind when preparing figures that coordination with the IEEE Standards Activities Department at the earliest stage can help ensure the most accurate and timely publication of a standard after approval. An IEEE Standards project editor should be contacted while figures are still in development.<sup>9</sup>

The following guidelines should be followed when preparing electronic art:

- a) Consistent typographical specifications for text notations (“captions”) used in artwork should be used. The IEEE Standards Activities Department requires True Type fonts (New Times Roman or Arial) for captions, preferably in 8-point type size. In no case should captions be in a font smaller than 6 points or in a font other than the True Type fonts listed previously. All capital letters or mixed uppercase and lowercase letters may be used, depending on the amount of text, as long as the presentation is consistent throughout the document. Letter symbols not normally capitalized should always be lowercase (see Figure 4).
- b) Figures should be created originally in a graphics program<sup>10</sup>). Figures created in programs that do not support vector illustrations may result in bitmapped graphics or graphics that do not translate well into other applications. The graphics may not scale appropriately or retain their quality.
- c) A separate electronic file should be created for each figure in a document and named in correspondence to the figure number (e.g., FIG1.TIF). Multiple figures under a single figure number (e.g., Figure 2a and Figure 2b) should be saved as separate files with corresponding names (e.g., FIG2A.TIF, FIG2B.TIF). Although saved as separate files, they should be submitted to the IEEE on a single disk or CD-ROM, or as a single compressed file. (See 4.3 for complete guidance on electronic submittal.)
- d) Graphics files created in a graphic program should be saved as black and white (at 300 dpi) or gray scale (at 150 dpi) in one of the following formats: Encapsulated PostScript (EPS), Tagged Image File Format (TIFF), or Windows Metafile Format (WMF). All fonts shall be embedded in the figures and all elements within a figure shall be grouped. If the document is a FrameMaker file, the FrameMaker graphics editor can be used for simple line drawings and TIFF versions do not need to

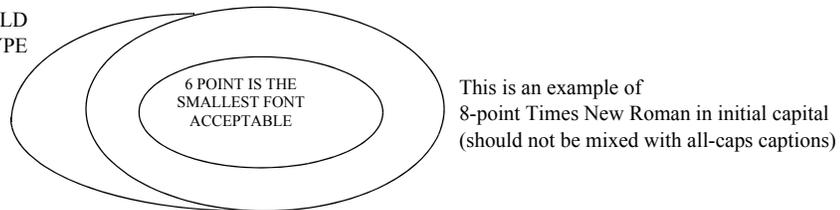
<sup>9</sup>A helpful resource for creating graphics is *Guidelines for Author Supplied Electronic Text and Graphics* available from the IEEE Web site <[http://www.ieee.org/portal/cms\\_docs/pubs/transactions/eic-guide.pdf](http://www.ieee.org/portal/cms_docs/pubs/transactions/eic-guide.pdf)>. The guidelines for electronic text files in this document do not apply to standards drafts. Contact an IEEE Standards project editor for questions regarding graphics (stds-style@ieee.org).

<sup>10</sup>The following information is given for the convenience of users of this document and does not constitute an endorsement by the IEEE of these products. Equivalent products may be used if they can be shown to lead to the same results. Examples of graphics programs are Adobe® Illustrator®, Visio®, PaintShop™ Pro®, and AutoCAD®. Adobe® Illustrator® is a registered trademark of Adobe Systems Incorporated in the United States and/or other countries. Visio® is a registered trademark of Microsoft Corporation in the United States and/or in other countries. PaintShop™ Pro® is a registered trademark of Jasc Software Incorporated in the United States and/or other countries. AutoCAD® is a registered trademark of Autodesk, Incorporated in the United States and/or other countries.

be submitted. If the working group is unsure of how a graphic file was created, a TIFF version of the file should be submitted. Figure files that do not comply with the requirements stated in this clause may be converted to TIFF, which will result in a bit mapped version of the figure. If the working group cannot provide graphics in these formats or would like to inquire about other possible formats that may be used, please contact an IEEE Standards project editor.

- e) Whenever possible, original art files (from the graphics programs used) should also be submitted to the IEEE. The original art files should be grouped separately from those saved in the formats listed previously. All original art files will be archived for the working group but will not be used during the publication process.
- f) Although the IEEE requires that figures are embedded in the draft for the purposes of the ballot, separate files also shall be submitted for publication purposes.

SHORTER CAPTIONS SHOULD  
BE ALL CAPS, IN 8-POINT TYPE



**Figure 4—Typographical specifications for figure captions**

Working groups shall obtain permission to use any figure taken from another source, including from a manufacturer, preferably prior to using it in a draft standard (see 4.1 and Clause 5).

A figure should be labeled by the word *Figure* followed by a number, a dash, and a title as shown in Figure 4.

## 16.2 Numbering and capitalization

Figures should be numbered consecutively in a separate series and in the order of their reference in the text (e.g., Figure 1, Figure 2, Figure 3). Hyphenated numbers should not be used except in standards of considerable length. In the latter case, it is appropriate to label the first figure in a clause with the number 1, preceded by the clause number (e.g., Figure 6-1, Figure 6-2, Figure 6-3).

Figures included in annexes should carry the identifying letter of the annex in which they appear, followed by a period. For example, the first figure in Annex A should be identified as Figure A.1.

A figure should be referenced in the text by the word *Figure* and its number only (e.g., “see Figure 1”). If referring to two or more figures in the same sentence, each should be named separately. For example, use “see Figure 1, Figure 2, and Figure 3,” instead of “see Figures 1 through 3.”

Only the initial letter of the first word and proper nouns should be capitalized in figure titles.

NOTE—See 15.3 for information on the numbering of tables.

## 16.3 Notes and footnotes to figures

A note to a figure is not an official part of the standard and should immediately follow the figure to which it belongs. (See Clause 18 for information on the style for notes.) If the text is mandatory, it should appear in the body of the standard. Important information on safety, health, or the environment shall not be included in notes to figures. Notes to a figure should appear in the following order:

- a) *General notes.* General notes apply to the entire figure and should be introduced by “NOTE—” set in upright capital letters. Multiple notes in sequence should be numbered “NOTE 1—”, “NOTE 2—”, etc.

- b) *Crediting source.* Use either of the following credit lines.
- 1) Reprinted with permission from... (Use when the figure is derived from another source from which permission to reproduce has been obtained.)
  - 2) Source: (Use when figure is derived from another IEEE standard.)
- c) *Notes on specific parts of the figure.* Specific notes should be introduced by “NOTE—” set in upright capital letters. Multiple notes in sequence should be numbered “NOTE 1—”, “NOTE 2—”, etc., or continue the numbering of the general notes.

Footnotes to figures may contain normative information. They should be marked with lowercase letters starting with “a” for each figure. (See Figure A.1 in Annex B.)

## 17. Mathematical expressions

### 17.1 Letter symbols and units

Letter symbols from applicable IEEE standards (see Clause 2) should be used in preparing mathematical expressions. (See 14.4 for a discussion of letter symbols.)

All terms shall be defined, including both quantities and units, in a tabulation following the equation [see Equation (1)]. The list should be preceded by the word *where*, followed by the list of variables and corresponding definitions.

### 17.2 Numbering of equations

If the standard contains more than one equation, then equations of key importance should be numbered consecutively in parentheses at the right margin. Derivations of equations or examples where values are substituted for variables need not be numbered.

An equation should be cited in the text by the word *Equation* and its number only [e.g., “see Equation (1)”]. If referring to two or more equations in the same sentence, each should be named separately. For example, use “see Equation (1), Equation (2), and Equation (3),” instead of “see Equations (1) through (3).”

### 17.3 Presentation of equations

A multiplication sign ( $\times$ ), rather than the letter “x” or a multidot ( $\cdot$ ), should be used to indicate multiplication of numbers and numerical values, including those values with units (e.g., 3 cm  $\times$  4 cm).

Although the stacked style of fractions is preferred, exceptions should be made in text to avoid printing more than two lines of type. For example, in text  $a/b$  is preferable to  $\frac{a}{b}$ .

The general rules regarding the use of upright and italic text in equations [see Equation (1)] are as follows:

- Quantity symbols (including the symbols for physical constants), subscripts or superscripts representing symbols for quantities, mathematical variables, and indexes are set in italic text.
- Unit symbols, mathematical constants, mathematical functions, abbreviations, and numerals are set in upright text.

*Example:*

$$x = r \sin \theta \cos \phi \quad (1)$$

where

- $x$  is the x-coordinate on a cartesian plane
- $r$  is the length of the position vector
- $\theta$  is the angle between the position vector and a coordinate axis
- $\phi$  is the angle from the plane in which both the axis and the position vector lie to either of the coordinate planes including that axis

Table 4 lists a number of functions and operators that are commonly set in upright text.

**Table 4—Examples of functions and operators set in upright text**

arg (argument)	hom (homology)	min (minimum)
cos (cosine)	Im (Imaginary)	mod (modulus)
cot (cotangent)	inf (inferior)	Re (Real)
det (determinant)	ker (kernal)	sin (sine)
diag (diagonal)	lim (limit)	sup (superior)
dim (dimension)	log (logarithm)	tan (tangent)
exp (exponential)	max (maximum)	var (variance)

Further examples of the presentation of equations are given in Equation (2) and Equation (3). Equation (2) illustrates the use of italics and exponential function in an equation. Equation (3) shows the alternative use of exponential function to avoid double superscripts.

$$C_{d_3} = \frac{\lambda T_s}{1 - e^{-\lambda T_s}} \quad (2)$$

where

- $C_{d_3}$  is the correction factor for decay during sample collection
- $\lambda$  is the radionuclide decay constant
- $T_s$  is the sampling duration
- $e$  is the base of the natural logarithm

$$Y(x) = Y_0 \exp[-(x - x_0)^2 / (2f^2)] \quad (3)$$

where

- $Y(x)$  is the amplitude of the Gaussian function at channel  $x$
- $Y_0$  is the height of the Gaussian at the centroid channel
- $x$  is the channel number
- $x_0$  is the centroid of the Gaussian
- $f$  is the width of the Gaussian

## 17.4 Quantity and numerical value equations

Equations shall be dimensionally correct. Equations may be in either quantity equation form or in numerical value equation form. Stipulation of units for substituted values in the variable list below the equation does not suffice to meet this requirement.

A quantity equation is valid regardless of the units used with the substituted values, once any unit conversions and prefix scaling factors have been taken into account. For example,  $F = ma$  is always correct.

A numerical value equation depends on the use of particular units and prefixes. Such equations may be presented in one of two forms. One form represents a numerical relationship among quantities whose dimensions have been reduced to 1 due to division by the appropriate (prefixed) units. For example,

$$t/^{\circ}\text{C} = T/\text{K} - 273.15$$

The other form annotates the quantities with the units to be used. For example,

$$\{t\}_{^{\circ}\text{C}} = \{T\}_{\text{K}} - 273.15$$

## 18. Notes, footnotes, examples, warnings, and cautions

### 18.1 Notes

Explanatory statements may be used in the text for emphasis or to offer informative suggestions about the technical content of the standard. These notes provide additional information to assist the reader with a particular passage and shall not include mandatory requirements. A note in the text is *not* an official part of the approved standard; therefore, important information on safety, health, or the environment shall not be included. A note should follow that paragraph to which it belongs, and shall be set apart from the text by introducing the statement with the capitalized word “NOTE—.” Within each subclause, multiple notes in sequence should be numbered “NOTE 1—”, “NOTE 2—”, etc. (See Annex B for examples.)

“Note that” is normative and is translated to mean “pay special attention to.” “Note that” is usually part of a paragraph while “NOTE—” is set apart as its own paragraph.

### 18.2 Footnotes

Footnotes in text may be included in a standard only for information, clarification, and/or aid applicable to the use of the standard. Mandatory requirements shall not be included in text footnotes because these footnotes are not officially part of the standard. Note that footnotes to tables and figures follow different rules (see 15.5 and 16.3).

Footnotes in the front matter should be indicated separately from the body footnotes. Front-matter footnotes should be indicated with lowercase letters.

Footnotes in the body and annexes should be numbered consecutively using Arabic numerals. When there are footnotes within tables and figures, they should be lettered. If a footnote is cited more than once, each additional citation should refer back to its first mention as follows:

<sup>2</sup> See Footnote 1.

## 18.3 Examples

Examples may be used as illustrations to aid understanding of the standard. Examples are not an official part of the standard; therefore, requirements shall not be included in the text of the example. (See 18.4 and Clause 19 for illustrations of examples.)

## 18.4 Warnings and cautions

Warnings call attention to the use of materials, processes, methods, procedures, or limits that have to be followed precisely to avoid injury or death. Cautions call attention to methods and procedures that have to be followed to avoid damage to equipment. A warning is more important than a caution. If both are to be written for the same related clause or subclause, the warning shall precede the caution.

Warnings and cautions should start with a clear instruction, followed with a short explanation (if necessary). If the warning or caution is of a general nature (and is applicable throughout the text), it should be placed at the start of the text. This avoids the necessity of repeating the same warning or caution frequently throughout the text. Warnings and cautions shall not be placed in informative text or notes.

*Example:*

<p><b>WARNING</b></p> <p>Serious injury may result if the following parameters are not followed exactly.</p>
--

## 19. Bibliography

### 19.1 General

Complete and current information for bibliographic entries shall be supplied by the working group. The bibliography always shall be an informative lettered annex that appears as either the first or last annex of the standard (if an index is included, the annexes would precede the index). (See Annex A for an example bibliography.)

If bibliographic items are cited in text, tables, figures, or notes, the citation should be placed at the point where reference is made to them. If the item is a standard, the designation (e.g., IEEE Std 1226.6-1996) and bibliographic reference number (e.g., [B4]) should be cited. If the reference is to an article, book, or other type of publication included in the bibliography, the title or author of the publication and the bibliographic reference number should be cited.

The bibliography should be ordered alphanumerically, without respect to the type of publication being cited.

### 19.2 Standards

Standards listed shall include designation and title.

*Example:*

[B1] ASME BPVC-I-2004, Boiler and Pressure Vessel Code, Section 1—Power Boilers.

[B2] Code of Federal Regulations Title 29 Part 1210 Section 354 (29CFR1210.354), Health and Safety Standards—Head injury.

[B3] ISO/IEC 7498-4, Information processing systems—Open Systems Interconnection—Basic Reference Model—Part 4: Management framework.

### 19.3 Articles in periodicals

Articles listed shall include the following information in the order shown:

- a) Last name of author or authors and first name or initials, or name of organization
- b) Title of article in quotation marks
- c) Title of periodical in full and set in italics
- d) Volume, number, and, if available, part
- e) First and last pages of article
- f) Date of issue

*Example:*

[B1] Boggs, S. A. and Fujimoto, N., “Techniques and instrumentation for measurement of transients in gas-insulated switchgear,” *IEEE Transactions on Electrical Installation*, vol. ET-19, no. 2, pp. 87–92, Apr. 1984.

### 19.4 Books

Books listed shall include the following information in the order shown:

- a) Last name of author or authors and first name or initials, or name of organization
- b) Title of book (in italics)
- c) Edition number (if applicable)
- d) Place of publication (city)
- e) Name of publisher
- f) Year of publication
- g) First and last page of reference

*Example:*

[B26] Peck, R. B., Hanson, W. E., and Thornburn, T. H., *Foundation Engineering*, 2d ed. New York: McGraw-Hill, 1972, pp. 230–292.

NOTE—Consult *The Chicago Manual of Style* [B1] for more information on how to list books and periodicals.

### 19.5 Other types of bibliographies

#### 19.5.1 Annotated bibliography

[B10] Henry, S., and Selig, C., “Predicting source-code complexity at the design stage,” *IEEE Software*, vol. 7, no. 2, pp. 36–44, Mar. 1990.

*This paper states that the use of design metrics allows for determination of the quality of source code by evaluating design specifications before coding, causing a shortened development life cycle.*

### 19.5.2 Articles in corporate reports

[B6] Dale, S. J., “Performance of a technical and economic feasibility study of an HVDC compressed gas-insulated transmission line,” Westinghouse Electric Corporation, Trafford, PA, Final Report, Dec. 1983.

### 19.5.3 Articles presented at conferences

[B3] Cookson, A. H., and Pedersen, B. O., “Thermal measurements in a 1200 kV compressed gas insulated transmission line,” *Seventh IEEE Power Engineering Society Transmission and Distribution Conference and Exposition*, Atlanta, GA, pp.163–167, Apr. 1979.

### 19.5.4 Government publications

[B2] Cookson, A. H., “Particle Trap for Compressed Gas Insulated Transmission Systems,” U.S. Patent no. 4554399, Nov.1985.

[B3] EPRI EL-2040, Project 1352-1, *Probability-Based Design of Wood Transmission Structures—Volume 3: User’s Manual, POLEDA-80—POLE Design and Analysis*, Final Report, Goodman, J., Vanderbilt, M., Criswell, M., and Bodig, J.

### 19.5.5 Theses, dissertations, and other unpublished works

[B5] Diessner, A., “Studies on Compressed Gas Insulation.” Master’s thesis, Stanford University, 1969.

[B6] Hazel, R. L., “DC Breakdown and Anode Corona Characteristics of Sphere and Rod-Plane Gaps Insulated With Compressed Sulphur Hexa fluoride.” Ph.D. diss., University of Windsor, 1974.

## 20. Revisions

Working groups with access to the electronic publishing tools used by the IEEE Standards Activities Department should be aware that source files of text and graphics are usually available for electronic revision. Therefore, those who are working on a revision should contact an IEEE Standards project editor.

## 21. Amendments and corrigenda

### 21.1 General

Changes to standards can be implemented by issuing amendments and corrigenda.

An amendment is a document that contains new material to be incorporated into an existing IEEE standard and that may contain technical corrections to that standard as well. A corrigendum is a document that contains only technical corrections to an existing IEEE standard.

Amendments and corrigenda are balloted documents that give explicit instructions on how to change the text in an existing base standard or an existing amendment. The requirements for amendments and corrigenda are the same as for standards. However, these documents also contain editing instructions for each change. The editing instructions are important because the user should understand how the changes affect the base standard and because these documents are incorporated into the base standard sometime in the future.

Both types of documents have the same format. The following text shall appear at the beginning of either an amendment or a corrigendum:

NOTE—The editing instructions contained in this <amendment/corrigendum> define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~striketrough~~ (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this NOTE will not be carried over into future editions because the changes will be incorporated into the base standard.

Editing instructions and text indicating the changes to the base document follow the NOTE. Change bars shall not be included. (See Annex C for an example of an amendment/corrigendum.) Only material being affected by the changes of the amendment/corrigendum shall be included with the appropriate clause/subclause headings.

## 21.2 Numbering in amendments and corrigenda

Amendments and corrigenda shall follow the clause numbering outlined in Clause 11. However, if text is inserted between existing consecutive clauses or subclauses, an additional letter may be included in the heads (e.g., if clauses are inserted between Clause 4 and Clause 5, the new clauses would be labeled Clause 4A, Clause 4B, Clause 4C). This would also apply to subclauses (e.g., subclauses inserted between 4.1.3 and 4.1.4 would be labeled 4.1.3a, 4.1.3b, 4.1.3c). Subdivisions of inserted subclauses would follow the numbering outlined in Clause 11 (e.g., 4.1.3a.1, 4.1.3a.2, 4.1.3a.3). This numbering may be more appropriate for amendments with extensive changes that would affect numbering throughout the base standard (so it would be difficult to outline all the numbering changes that would occur), or for amendments to standards where exact references to clauses, figures, equations, and tables are required.

Additional amendments to a base standard may insert text between already amended clauses or subclauses. In these cases, numbering of clauses may become very complex. An IEEE Standards project editor can assist with complex numbering formats. Working groups should consider a revision of the document in these instances. For tables and figures in amendments and corrigenda, clause or subclause numbering should follow the numbering outlined in 15.3 and 16.2. However, if an amendment or corrigenda inserts a table between consecutive tables, or a figure between consecutive figures, the addition of a letter may be used.

Exceptions may be made for numbering established in previously published amendments. Exceptions shall only be valid until a revision occurs, after which the numbering described in Clause 11 will be implemented. Table 5 shows appropriate numbering formats that may be used for amendments and corrigenda. (See Annex C for examples of amendment numbering.)

## 21.3 Editorial instructions

Amendments submitted for ballot shall clearly indicate the changes to the existing standard. Editorial instructions shall clearly outline how the changes should be implemented in the base standard, as modified by all previously approved amendments or corrigenda. The instructions shall not require interpretation by the IEEE Standards project editor, by the balloter, or by any user. Therefore, the placement of the changes, as well as any renumbering that is required, shall be delineated in a manner that does not result in ambiguities.

Editorial instructions shall precede all changes, and should begin with one of the four types of editing instructions, which are formatted in bold italic: ***change***, ***insert***, ***delete***, and for figures or equations, ***replace***. ***Change*** shall be used when text or tables are being modified, therefore ~~striketrough~~ (for deletions) and underscore (for insertions) should be indicated. ***Insert*** shall be used to include new text, equations, tables, or

figures in the standard. **Delete** shall be used to remove existing text, equations, tables, or figures without exchanging the information (i.e., it is not permissible to delete a paragraph and insert a new one rather than showing the changes in the paragraph using the **change** instruction). **Replace** shall be used only for figures and equations by removing the existing figure or equation and replacing it with a new one. (See Annex C for examples of editorial instructions in amendments or corrigenda.)

Additional tips for creating amendments and corrigenda are available from the IEEE Standards Web site <<http://standards.ieee.org/guides/style/index.html>>. IEEE Standards project editors are also available for questions that arise while preparing these documents.

## 21.4 Amendment versus revision

The greater the number of amendments or corrigenda associated with a standard, the more complex the editing instructions become for all subsequent amendments and corrigenda. If three amendments to a standard exist however, working groups are encouraged to revise the standard rather than develop an additional amendment (see 8.1.2 and 9.2 of the *IEEE-SA Standards Board Operations Manual* [B6] for additional information and exceptions).

For an amendment, only the changes and the respective editorial instructions go before balloters. For revisions, the entire document is open for comments.

Table 5 lists examples of numbering schemes for amended clauses included in amendments and corrigenda.

**Table 5—Numbering of amended clauses**

Location of inserted clause	Original order of clauses	Revised order of clauses
<b>Clause heads</b>  First level	Clause 1 Clause 2	Clause 1 Clause 1A 1A.1 Clause 1B Clause 2
Second level	1.1 1.2	1.1 1.1a 1.1a.1 1.1b 1.2
<b>Figures</b>	Figure 1 Figure 2	Figure 1 Figure 1a Figure 1b Figure 2
<b>Tables</b>	Table 1 Table 2	Table 1 Table 1a Table 1b Table 2
<b>Equations</b>	Equation (1) Equation (2)	Equation (1) Equation (1a) Equation (1b) Equation 2
<b>Annexes</b>  Annex heads	Annex A Annex B	Annex A Annex A1 Annex A2 Annex B
First level	A.1 A.2	A.1 A.1a A.1a.1 A.1b A.2
Second level	A.1.1 A.1.2	A.1.1 A.1.1a A.1.1a.1 A.1.1b A.1.2

## 22. IEEE standards and ISO, IEC, and ITU

### 22.1 Preparing for submissions

Working groups preparing IEEE standards may wish to submit their standards to ISO, IEC, or ITU. The IEEE Standards Activities Department offers guidance to working groups on preparation of their documents from both a stylistic and technical perspective.

If there is an interest in such submissions, working group chairs should contact an IEEE Standards project editor early in the development cycle of their standards. Issues involving coordination and/or cooperation from committees from ISO, IEC, or ITU should be directed to your Standards staff liaison. The requirements contained in the IEEE copyright notice for draft standards shall be followed (see 4.2.2).

### 22.2 Adoption of ISO and IEC style requirements

The IEEE Standards Activities Department has harmonized its style with the principles of ISO/IEC style, as stated in the *ISO/IEC Directives Part 2* [B8]. However, the IEEE has made some exceptions to the ISO/IEC directives. The following guidelines may prove helpful in understanding these exceptions:

- a) The IEEE will continue to designate and to title standards according to 4.2.3 and 9.1. If a working group intends that its standard should one day be an ISO/IEC standard, the chair should consult with IEEE staff when preparing the PAR so that the title incorporates ISO/IEC considerations.
- b) While ISO and IEC do not credit individual members of their developing committees, the IEEE will continue to credit its working group and the voting members of the group in the informative front matter of standards. Groups developing ISO/IEC standards should consult with IEEE Standards project editors to clarify their actions with regard to this.
- c) ISO and IEC mandate the use of a foreword in their documents (in addition to the IEEE introduction). The foreword gives the development history of the document, including a statement of significant technical changes from any previous edition of the document, and may include:
  - A list of any other international organization that has contributed to the preparation of the document;
  - A statement that the document cancels and replaces other documents in whole or in part;
  - The relationship of the document to other documents;
  - In IEC, an indication of the next maintenance result date.
- d) The IEEE will continue to use the period as a decimal sign rather than the comma.
- e) Format of definitions and notes in IEEE draft standards will comply with 10.5 and 18.1.
- f) Since American English is acceptable internationally, the IEEE will continue to use American English grammar and spelling in its standards. This should pose no difficulty to groups developing international standards. In cases where British spelling is used in an internationally recognized term (e.g., “Fibre Distributed Data Interface”), that spelling may be retained.
- g) ISO/IEC uses an introductory paragraph to the normative references that may be different from that in IEEE standards, and working groups looking at ISO/IEC standardization should consider using this paragraph, which is available from IEEE Standards project editors.
- h) Working groups that intend to submit their drafts for review by JTC1 should ensure that any included normative references meet the JTC1 requirements for references. ISO/IEC requires that referenced standards that are not ISO or IEC standards be accompanied by appropriate documentation.
- i) ISO and IEC use lowercase letters and periods in abbreviated terms consisting of the initial letters of words (e.g., “a.c.” for “alternating current”); however, the IEEE style of not using periods in abbreviations and acronyms is acceptable.

The following information should be useful for those who are developing standards that will be forwarded to ISO or IEC. IEEE Standards project editors may be consulted to help determine the best options for formatting documents that are intended for adoption by ISO or IEC.

- a) Stylistic changes may be considered technical changes by ISO or IEC (e.g., capitalization of “standard” to “Standard” when self-referencing the document). These stylistic requirements should be determined and then communicated to IEEE project editors as a part of the submission of the draft standard to RevCom for final approval by the IEEE-SA Standards Board.
- b) The use of trade names, product names, and trademarks within the standard should be avoided.
- c) All subclauses within a clause shall be titled.
- d) Families of documents should be similar in organization and in their use of definitions.
- e) The foreword should contain any mention of closely related standards, changes from any previous editions of the standard, and the structure of the normative and informative parts of the standard. Historical or specific technical commentary about the preparation of the standard should be included in the introduction.
- f) All tables and figures should be titled and numbered consecutively (except as noted in 15.2 and 16.2). Numbering of figures within clauses is not allowed (e.g., Figure 1-1, Figure 1-2, Figure 1-3).
- g) Ranges should repeat the unit (i.e., 115 V to 125 V, not 115–125 V).
- h) Photographs should be avoided as artwork; if possible, concepts should be depicted as drawings rather than photographs.
- i) Cross-references using page citations are not permitted.
- j) The bibliography is the last annex (i.e., there is no option to place the bibliography as the first annex).

### **22.3 IEEE adoption of ISO, IEC, ITU, or other international standards**

Working groups interested in the adoption of international standards shall follow the procedure for submission of independently developed documents outlined in 5.3. Some international organizations have established guidelines for adoption that will need to be followed (e.g., international organizations may have restrictions against adopting International Standards as recommended practices or guides; information on regional or national adoption of ISO and IEC standards are given in ISO/IEC Guide 21 [B9]). Working groups will need to notify the IEEE Standards Activities Department ([stds.ipr@ieee.org](mailto:stds.ipr@ieee.org)) prior to initiating the adoption process.

## Annex A

(informative)

### Bibliography

For general style not outlined in this manual, the IEEE Standards Activities Department follows *The Chicago Manual of Style* [B1] as the primary reference and *Words Into Type* [B12] as a secondary reference.

The most recent editions of the following texts are recommended as guides on points of editorial style and usage:

[B1] *The Chicago Manual of Style*. Chicago: The University of Chicago Press.

[B2] *IEC Multilingual Dictionary—Electricity, Electronics, and Telecommunications* (available on CD-ROM). 2005, Edition 6.

[B3] IEC 60050, IEC International Electrotechnical Vocabulary.

[B4] *IEEE-SA Standards Board Bylaws*, New York: Institute of Electrical and Electronics Engineers, Inc.

[B5] *IEEE-SA Standards Companion*, New York: Institute of Electrical and Electronics Engineers, Inc.

[B6] *IEEE-SA Standards Board Operations Manual*, New York: Institute of Electrical and Electronics Engineers, Inc.

[B7] IEEE 100, *The Authoritative Dictionary of IEEE Standards Terms*, Seventh Edition, New York, Institute of Electrical and Electronics Engineers, Inc.

[B8] ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards.

[B9] ISO/IEC Guide 21, Regional or national adoption of International Standards and other International Deliverables.

[B10] Miller, C., and Swift, K. *The Handbook of Nonsexist Writing*. New York: HarperCollins.

[B11] *Webster's New Collegiate Dictionary*. Springfield, MA: Merriam-Webster, Inc.

[B12] *Words Into Type*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

## **Annex B**

(informative)

### **Example draft standard**

The following pages contain an example draft standard that points out common style issues. This example is meant to be used as a quick and easy reference to issues discussed in this manual. In most instances, a clause or subclause has been provided for easy reference.

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*Tags found in the IEEE template are shown in angled brackets <>, and precede the notes.*

*<Title> The title of the standard should be the same as that on its PAR. "IEEE" shall not appear in the title of a draft standard. See 9.1.*

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*Remember to include the standards designation, the draft number, and the date at the top right of every page. See 4.2.3.*

# IEEE P12345™/D1 Draft Recommended Practice for Rating Structure for AC High-Voltage Circuit Breakers

Prepared by the

Power Switchgear Working Group  
Switchgear Standards Committee  
IEEE Power Engineering Society

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New York, NY 10016-5997, USA  
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*This is the draft copyright statement that shall appear on the title page. See 4.2.2.*

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*Be sure to number every page of the draft. The front matter should use lowercase roman numerals. See 4.2.1.*

IEEE Standards Activities Department  
445 Hoes Lane  
Piscataway, NJ 08854, USA

*This notice shall appear centered at the bottom of each page of the draft. See 4.2.2.*

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*<INT> For more information on the introduction, see 9.3.*

## Introduction

*<IntDisclaimer> Since the introduction is not a part of the standard, this statement, enclosed in a boxed rule, needs to appear at the beginning.*

This introduction is not a part of IEEE P12345, Draft Recommended Practice for Rating Structure for AC High-Voltage Circuit Breakers.

This introduction provides style recommendations for IEEE drafts. This information is meant to aid in the understanding and usage of the IEEE Standards templates available from the IEEE Standards Web site <http://standards.ieee.org/resources/development/writing/templates.html>.

*Note that when a standard is a recommended practice or guide, it should be referenced to as such within the document.*

This recommended practice shows a sample document and includes notes (in bold, italic text) that identify tags for specific elements within IEEE templates. It also provides additional information for IEEE standards developers.

*Note that a colon is used to introduce a list only when the words "follows" or "following" are used, or if the sentence is complete*

The following are included in this document:

- Front matter
- Four clauses
- Two annexes

*<DL,DashedList> A dashed list can be used singly, but it is also used when there is a lettered list within the same subclause. This avoids confusing cross-references. See 11.3.*

*<LI,LetteredList> An ordered list is organized according to 11.3.*

This recommended practice is intended to satisfy the following objectives:

- a) Promote consistency within IEEE documents
- b) Reduce the time and effort needed to produce and approve IEEE standards
- c) Streamline the adoption of IEEE standards by international standards developers

The text of this recommended practice is sample text that contains errors. These errors will be corrected as a part of the example amendment/corrigenda shown in Annex C. Therefore, the format of the text and the notes should be considered, rather than the text on the pages.

## Patents

Attention is called to the possibility that implementation of this draft recommended practice may require use of subject matter covered by patent rights. By publication of this recommended practice, no position is taken with respect to the existence or validity of any patent rights in connection therewith. The IEEE shall not be responsible for identifying patents or patent applications for which a license may be required to implement an IEEE standard or for conducting inquiries into the legal validity or scope of those patents that are brought to its attention.

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### Participants

At the time this recommended practice was completed, the Power Switchgear<sup>a</sup> Working Group had the following membership:

*<CommitteeList> The working group members (except officers) are listed alphabetically in three columns. See 9.3.*

**Jane D. Brown, Chair**  
**Evan Goodman, Vice Chair**  
**Lee Hui, Secretary**  
**Karen Gonzales, Technical Editor**

*<Ch,Chair> Working group officers are placed above the list of working group members. The working group chair is responsible for providing this list and associated contact information. See 9.3.*

Karen Allison	Thomas Gray	Louis R. Mills
Ellen M. R. Augustine	Paul Haller	Rafael E. Padilla
David L. Boudreau	Frank Henninger	Robert H. Randolph
Rick Burgess	Lloyd Johnson	David P. Schwartz
Christopher Cooke	Miles Kehoe	Paulette Spink
Patricia M. Daggett	Bob Kessler	Richard Taylor

*The IEEE will provide the list of balloters.*

*The type of balloting committee (i.e., individual or entity) shall be stated. Only balloters who voted are listed in the document. See 9.3.*

The following entity members of the balloting committee voted on this standard. Balloters may have voted for approval, disapproval, or abstention.

Gerald Akin, ABC Corp.	Thomas Griffiths, NRC	Lewis Moore, StanMeade
David Ash, Consensus Inc.	Lee Hui, POQ-SADT	Robert Veek, XYZ Inc.

*Front matter footnotes should be indicated with lowercase letters. See 18.2.*

<sup>a</sup>This is for example purposes only.

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**Contents**

*<conthead> The table of contents follows the introduction and is the final heading in the front matter. Only clauses within the body of the document are listed.*

*<Contents> Only first- and second-level heads, and annexes should be listed in the table of contents. The contents shall be electronically generated. See 9.5.*

1. Overview ..... 1

    1.1 Scope ..... 1

    1.2 Purpose ..... 1

2. Normative references ..... 2

3. Definitions ..... 2

4. Rated transient recovery voltage ..... 3

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    5.1 Rated operating pressure for insulation and/or interruption ..... 7

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Annex C (informative) Bibliography ..... 13

*Whether the annex is normative or informative shall be included in parentheses. See 10.7.1.*

*Listing the clauses of an annex is optional.*

*Informative information (other than footnotes in text and notes in text, tables, and figures) shall be placed in informative annexes. See 10.1.*

*The bibliography shall be the first or last annex. See 19.1.*

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# IEEE P12345/D1

## Draft Recommended Practice for Rating Structure for AC High-Voltage Circuit Breakers

**1. Overview** *<H1,1stLevelHead> The overview is the first main clause (further subdivisions are called subclauses). If only the scope is included in the overview, the head shall be entitled "Scope." See 10.3.1 and 10.3.2.*

**1.1 Scope** *<H2,1.1> If the overview contains clauses other than the scope, the scope will be a subclause (second-level head) of the overview. The scope tells "what" is in the standard, and "what is not" in the standard. See 10.3.2.*

This recommended practice establishes a symmetrical current rating structure and construction recommendations for all indoor and outdoor types of ac high-voltage circuit breakers rated above 1000 V. It is only applicable to three-pole circuit breakers used in three-phase systems and single-pole circuit breakers used in single-phase systems. This recommended practice does not cover circuit breakers used at frequencies other than 50 Hz or 60 Hz, or generator circuit breakers that are covered in IEEE Std C37.013™-1997.<sup>1</sup>

**1.2 Purpose** *<H2,1.1> The purpose is an optional subclause (second-level head) of the overview. The purpose tells "why" the standard is needed. See 10.3.3.* *This is how a normative reference is cited in the document. See 10.4.3.*

Inconsistency in performance of high-voltage circuit breakers may result in interruption of current and reduction in service levels. The recommendations outlined in the following clauses are intended to provide consistent functionality for high-voltage circuit breakers rated above 1000 V.

*The first normative reference cited in the document outside the normative reference clause should have this footnote. For information on footnotes, see 18.2.*

<sup>1</sup>For information on references, see Clause 2.

*Be sure to number every page of the draft.*

<H1,1stLevelHead> If the standard contains references, they shall be listed in Clause 2. Normative references are those documents that must be available to the user of the standard for its implementation. Informative references are listed in the bibliography. See 10.4.

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graph to  
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definitions  
clause.  
See 10.5.2.

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<References> Dated references will appear in the published standard as listed in the draft. Reference documents that are not developed by recognized SDOs shall include an edition or date. Undated material indicates that the most current edition is the one required. Sponsors are responsible for determining whether dated or undated references are required. See 10.4.2.

## 2. Normative References

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ASME 2004 Boiler and Pressure Vessel Code, Section X, Fiber-Reinforced Plastic Pressure Vessels. *When listing a draft, "Std" is not included and a "P" (for project) comes directly before the standard number. A draft number and date is required.*

IEC 60056, High-voltage alternating-current circuit-breakers.

IEEE Std 4™-1978, IEEE Standard Techniques for High-Voltage Testing.

IEEE PC37.09™ (Draft 3, March 2003), Draft Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

IEEE Std C37.010™, IEEE Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis.

IEEE Std C37.013™-1997, IEEE Standard for AC High-Voltage Generator Circuit Breakers Rated on a Symmetrical Current Basis.

<H1,1stLevelHead> If the standard includes definitions, these shall be included in the clause immediately following the normative reference clause. If the standard does not contain normative references, then the definitions shall be listed in Clause 2. If acronyms and abbreviations are included, the title of the clause head shall be "Definitions, acronyms, and abbreviations." See 10.5 and 10.6.

## 3. Definitions

For the purposes of this document, the following terms and definitions apply. *The Authoritative Dictionary of IEEE Standards Terms* [B3]<sup>2</sup> and IEEE Std C37.100™ [B4] should be referenced for terms not defined in this clause.

### 3.1 capacitance current:

A reversible component of the measured current on charge or discharge of the winding that is due to the geometrical capacitance, i.e., the capacitance as measured with alternating current of power or higher frequencies.

*When referring to an annex in text, "Annex" should start with a capital A.*

---

<sup>2</sup>The number in brackets correspond to those of the bibliography in Annex C.

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The first bibliographic reference cited in the document should have this footnote.

<D2,Definitions> Each term shall be numbered and shall be in alphabetical order. Definitions shall be as generic as possible. Terms that already exist in The Authoritative Dictionary of IEEE Standards Terms should not be listed in the definitions clause unless reviewed by SCC10. They can be placed in an informative annex, entitled Glossary. See 10.5.

See 10.5.2 for more information on cross-references.

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**3.2 capacitor bank:** An assembly at one location of capacitors and all necessary accessories, such as switching equipment, protective equipment, and controls, required for a complete operating installation. It may be a collection of components assembled at the operating site or may include one or more piece(s) of factory-assembled equipment. *See also:* **component.**

**3.3 component:** The devices and equipment which are assembled at the erection site, or readily removed or accessed for maintenance, and which perform a function.

**3.4 restrike:** A resumption of current between the contacts of a switching device during an opening operation after an interval of zero current of 1/4 cycle at normal frequency or longer.

NOTE—See 4.3.

*Each definition shall be a brief, self-contained description of the term. The term shall not be used in its own definition or inverted, and the description shall not contain requirements. Cross-references to clauses, figures, tables, or equations within the document shall be placed in notes. See 10.5.2.*

## 4. Rated transient recovery voltage

### 4.1 General

*A subclause title "General" can be used to avoid hanging paragraphs. See 11.1.*

At its rated maximum voltage, each circuit breaker shall be capable of interrupting three-phase grounded and ungrounded terminal faults at the rated short circuit current in any circuit in which the transient recovery voltage (TRV) does not exceed the rated TRV envelope (see IEEE Std C37.010).

*Acronyms should be spelled out at the first use. See 13.6.*

Each TRV rating is defined for a three-phase circuit breaker.

### 4.2 Rated TRV parameters

The TRV rating for a three-phase circuit breaker is defined by an envelope of required withstand capability. The parameters that define the envelope are based on the characteristic features of actual system TRVs.

*Only the first letter of the first word and proper nouns shall be capitalized in clause and subclause titles. This is also true for table and figure titles. See 13.8.*

<sup>3</sup>Notes in text, tables, and figures of a standard are given for information only, and do not contain requirements needed to implement the standard.

*This footnote should be placed at the first occurrence of a note in text, tables, and figures. See 15.5, 16.3, and 18.2.*

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When referring to a table, figure, or equation within the text, "Table," "Figure," and "Equation" should start with a capital letter. See 15.2, 16.2, and 17.2.

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4.2.1 Circuit breakers rated below 100 kV

For circuit breakers rated below 100 kV, the rated transient recovery voltage (TRV) is represented by a 1-cosine wave, as shown in Figure 1. Equation (1) shows the magnitude of this wave, E<sub>2</sub>, for interrupting rated short circuit current.

See Clause 17 for information on equations.

E<sub>2</sub> = K<sub>a</sub> × K<sub>f</sub> × (√5/√3) × V (1)

where

- K<sub>a</sub> is the transient amplitude factor (1.54)
K<sub>f</sub> is the first pole-to-clear factor (1.5)
V is the rated maximum voltage

There are special requirements for creating figures, and for the format of the figures submitted to the IEEE. Note that figure titles are positioned below the figure and that the figures are numbered consecutively within the standard. Text in figures can be all uppercase or initial caps. See Clause 16 for information on figures.

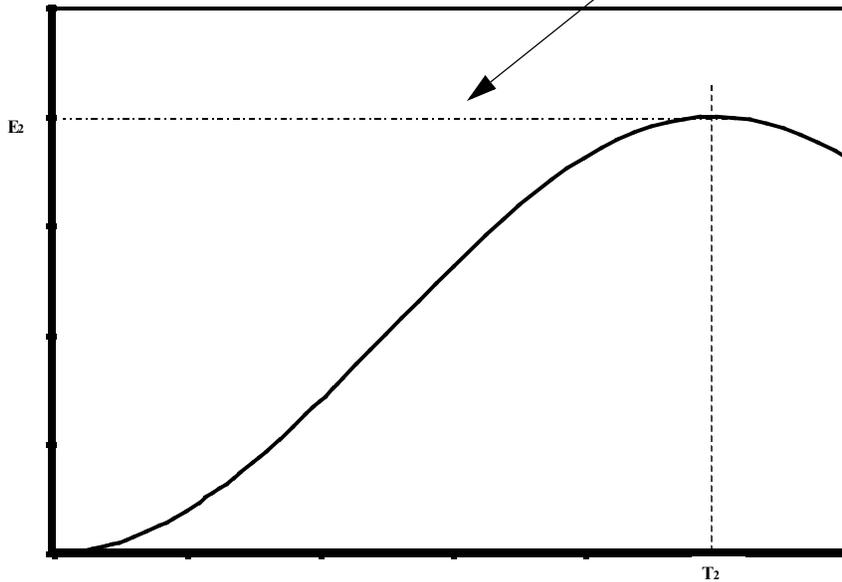


Figure 1—TRV waveform (1-cosine)

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Since systems below 100 kV may be operated ungrounded, a first pole-to-clear factor of 1.5 is required.

Thus,  $E_2$  has the value shown in Equation (2).

$$E_2 = 1.88V \quad (2)$$

#### 4.2.2 Circuit breakers rated 100 kV and above

For circuit breakers rated 100 kV and above, the rated TRV waveshape is defined by the higher of an exponential waveform and a 1-cosine waveform. The magnitude of the exponential component,  $E_1$ , is given in Equation (3).

$$E_1 = \frac{\sqrt{2}}{\sqrt{3}}VK_f \quad (3)$$

where

$K_f$  is the first pole-to-clear factor (1.3);

or

$$E_1 = 1.06V$$

*<Note> Notes always start with the word "NOTE" in capital letters, followed by a dash. Multiple notes in sequence are numbered. Notes are informative and shall not contain requirements or important safety information. See 18.1.*

Since most, if not all, systems operating at 100 kV and above are effectively grounded, a first pole-to-clear factor of 1.3 is required.

The rate of rise of the exponential component,  $R$ , has been established as 2 kV/ $\mu$ s, as shown in IEEE Std C37.010.

NOTE—A transient amplitude factor of 1.4 is used for circuit breakers rated 100 kV and above, instead of the 1.54 value used for circuit breakers rated below 100 kV.

The rated times to peak of the 1-cosine component,  $T_2$ , vary with circuit breaker rated voltage, as given in IEEE Std C37.010.

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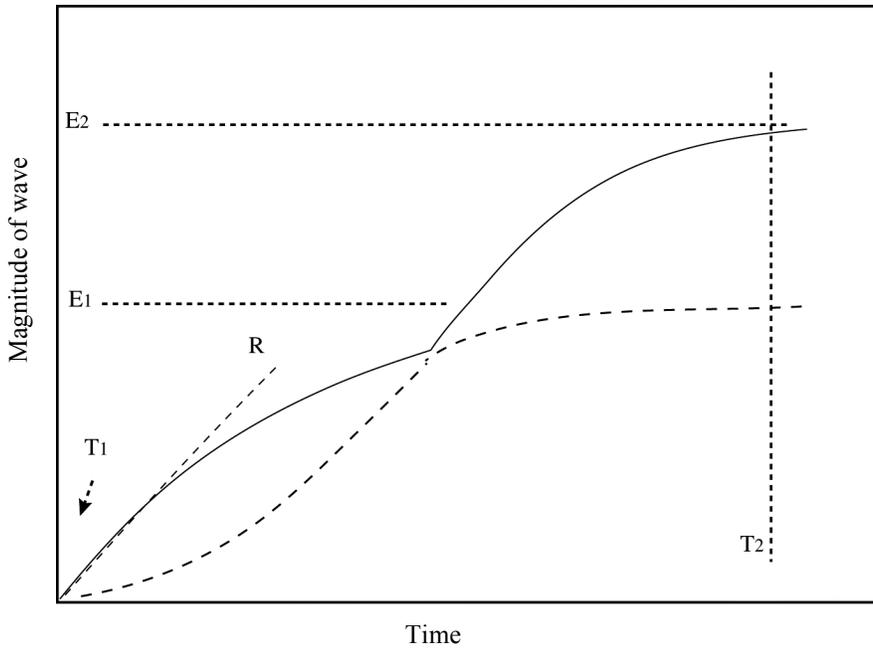
The rated magnitude of the exponential cosine component,  $E_2$ , in IEEE Std C37.010 is shown in Equation (4).

$$E_2 = \frac{\sqrt{2}}{\sqrt{3}} V K_a K_f \tag{4}$$

$$E_2 = \frac{\sqrt{2}}{\sqrt{3}} V(1.4)(1.3) = 1.49 V$$

*<EU, EquationUnnumbered>  
Derivations of equations or examples where values are substituted for variables need not be numbered. See 17.2.*

Figure 2 shows a slight delay,  $T_1$ , in the initial build-up of the TRV wave. This delay is due to the capacitance of the circuit breaker, faulted bus, and any other connected equipment. The rated values of  $T_1$  are shown in IEEE Std C37.010.  $T_1$  does not apply to circuit breakers rated below 100 kV.



**Figure 2—Exponential-cosine TRV waveform**

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The rated TRV parameters are summarized in Table 1 and are further described in IEEE Std C37.010.

*<TableTitle> See Clause 15 for more information on tables. Note that table titles appear above the table, and that the tables are numbered consecutively within the standard.*

**Table 1—Rated TRV parameters**

Breaker rating	Envelope	$E_2$	$T_2$	R	$E_1$	$T_1$
Below 100 kV	1-cos Figure 1	$1.88 \times V$	See IEEE Std C37.010	—	—	—
100 kV and above	Exp-cos <sup>a</sup> Figure 2	$1.49 \times V$	See IEEE Std C37.010	See IEEE Std C37.010	$1.06 \times V$	See IEEE Std C37.010

<sup>a</sup>Exponential cosine

*<CellHeading> In cell headings, as well as table titles and column headings, only the first letter of the first word and proper nouns shall be capitalized. See 15.3.*

*<CellBody> Use a dash for missing data. For more information, see 15.4.2.*

## 5. Pressure for insulation and/or interruption

### 5.1 Rated operating pressure for insulation and/or interruption ( $P_{re}$ )

The pressure, in Pascals (Pa), refers to the standard atmospheric air conditions of +20 °C and 101.3 kPa (absolute) (or density), which may be expressed in relative or absolute terms, to which the assembly is filled before being put into service or automatically replenished.

NOTE 1—Clause 4 of IEEE Std C37.010 contains guidelines for measuring rated operating pressure.

NOTE 2—Identification of rated operating pressure should include whether the pressure is expressed as relative or absolute.

### 5.2 Alarm pressure for insulation and/or interruption

*See 13.2 for information on the appropriate use of the word “which.”*

The pressure, in Pascals, refers to the standard atmospheric air conditions of +20 °C and 101.3 kPa (absolute) (or density), which may be expressed in relative or absolute terms, at which a monitoring signal may be provided to indicate that replenishment is necessary.

*<Note> Multiple notes in sequence are numbered. Notes are informative, and shall not contain requirements or important safety information. See 18.1.*

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**5.3 Minimum operating pressure for insulation and/or interruption**

The pressure in Pascals, for insulation and/or for interruption, refers to the standard atmospheric air conditions of +20 °C and 101.3 kPa (absolute) (or density), which may be expressed in relative or absolute terms, which represents the lower limit below which the circuit breaker rated performance and capabilities are no longer available and where the circuit breaker is locked-out.

*See 14.3 for information on letter symbols.*

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*<AN, Annex> Consecutive capital letters and a title shall be used to identify each annex.*

**Annex A**

*<Nor, Normative> This line indicates whether the annex is informative or normative. See 10.7.*

(normative)

*<AT, AnnexTitle> See 10.7 and 11.2 for information on annexes.*

**Example Annex**

*Annexes are organized similarly to text, except that the clause and subclause numbers shall be prefaced with the letter of the annex. See 11.2.*

**A.1 Mechanical loading**

**A.1.1 Outdoor circuit breaker**

This subclause applies to outdoor circuit breakers. For indoor circuit breakers, the requirements of IEEE Std C37.013-1997 apply.

*The term “clause” or “subclause” shall not be used in headings or references (i.e., use “see 3.2”, not “see subclause 3.2”) except when referring to major clause headings (e.g., “see Clause 5”). See 11.1.*

**A.1.2 Circuit breaker**

The maximum permissible mechanical loading that may be applied to a circuit breaker is as described in A.1.2.1 through A.1.2.4. All other mechanical loading is considered special, and application shall be checked with the manufacturer.

**A.1.2.1 Wind loading**

The circuit breaker shall be capable of withstanding a wind speed of 40 m/s. This requirement is only applicable to outdoor circuit breakers.

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**A.1.2.2 Seismic loading**

All circuit breakers shall be capable of withstanding at least 0.2 times the equipment weight applied in one horizontal direction, combined with 0.16 times the weight applied in the vertical direction at the center of gravity of the circuit breaker and support structure. The resultant load shall be combined with the maximum normal operating load to develop the greatest stress on the anchorage.

**A.2 Terminal loading**

The maximum permissible terminal mechanical loading that may be applied to an outdoor circuit breaker is given as static forces in Table A.1 (see Figure A.1). All other terminal loading in excess of these values is considered special, and application shall be checked with the manufacturer. The user shall consider all forces<sup>4</sup> acting on the conductors connected to the terminals.

*In annexes, tables are numbered alphanumerically. The letter stands for the letter of the annex. (When there is only one annex in a standard, use the letter A.) Immediately following the letter is a period and a number starting from one. See 11.2 and 15.3.*

**Table A.1—Terminal mechanical loading**

Rated maximum voltage	Rated continuous current	Static horizontal force		Static vertical force <sup>a</sup>
		Longitudinal (N)	Transverse (N)	Vertical (N)
Below 100 kV	1200 A and below	500	400	500
	Above 1200 A	750	500	750
123 kV to 170 kV	2000 A and below	1000	750	750
	Above 2000 A	1250	750	1000
245 kV	All	1250	1000	1250
362 kV to 800 kV	All	1750	1250	1250

<sup>a</sup>Vertical axis forces are upward and downward.

*Table footnotes are an official part of the standard; i.e., they are normative. See 15.5.*

<sup>4</sup>Forces include wind, ice, seismic, and short-circuit forces.

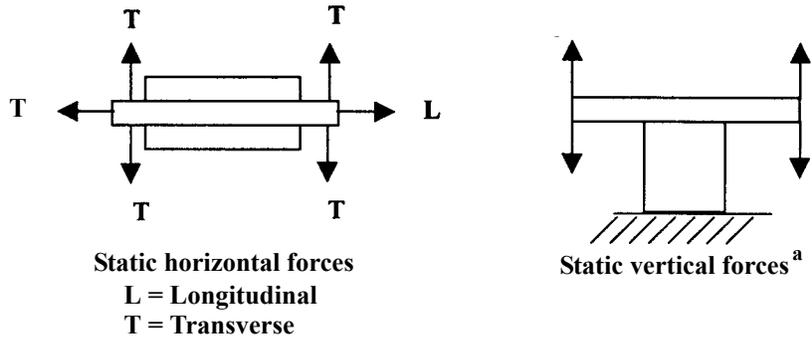
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*Unlike annex table and figure titles, footnotes in an annex are numbered continuously from the standard. Footnotes in text are not an official part of the standard; i.e., they are informative. See 18.2.*

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**Static horizontal forces**  
**L = Longitudinal**  
**T = Transverse**

<sup>a</sup> Static vertical forces shown on grounded circuit breaker.

**Figure A.1—Direction of terminal mechanical loading forces**

*<AFigTitle> In annexes, figures are numbered alphanumerically. The letter stands for the letter of the annex. (When there is only one annex in a standard, use the letter A.) Immediately following the letter is a period and a number starting from one. For more information, see 16.2.*

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## Annex B

(informative)

*Terms used in the document that already exist in The Authoritative Dictionary of IEEE Standards Terms can be listed in an informative annex, not in the definitions clause in the main body of the standard. See 10.5.*



## Glossary

For the purposes of this document, the following terms and definitions apply. These and other terms within IEEE standards are found in *The Authoritative Dictionary of IEEE Standards Terms* [B1].

**circuit breaker:** A device designed to open and close a circuit by nonautomatic means, and to open the circuit automatically on a predetermined overload of current, without injury to itself when properly applied within its rating.

**continuous current:** The maximum constant rms power frequency current that can be carried continuously without causing further measurable increase in temperature rise under prescribed conditions of test, and within the limitations of established standards.

**loading:** The modification of a basic antenna such as a dipole or monopole caused by the addition of conductors or circuit elements that change the input impedance or current distribution or both.

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## Annex C

(informative)

*The bibliography is always an informative annex.*

*The bibliography shall contain publications that are for purposes of information or documentation only. Bibliographic entries should be listed in alphanumeric order. See Clause 19.*

*Since EPRI standards are not readily available to the public, they cannot be used as references and therefore must be referenced in the bibliography.*

### Example bibliography

[B1] Bridges, J.E., Vainberg, M., and Willis, M. C., "Impact of Recent Developments in Biological Electrical Shock Safety Criteria," *IEEE Transactions on Power Delivery*, vol. PWRD-2, no. 1, pp. 238–248, Jan. 1999.

[B2] EPRI EL-2040, Project 1352-1, *Probability-Based Design of Wood Transmission Structures—Volume 3: User’s Manual, POLEDA-80—POLE Design and Analysis*, Final Report, Goodman, J., Vanderbilt, M., Criswell, M., and Bodig, J.

[B3] IEEE 100, *The Authoritative Dictionary of IEEE Standards Terms*, Seventh Edition, New York, Institute of Electrical and Electronics Engineers, Inc.

[B4] IEEE Std C37.100, IEEE Standard Definitions for Power Switchgear.

[B5] Willis, R., and Deutsch, M., *Software Quality Engineering*. Englewood Cliffs, NJ: Prentice Hall, 2003.

[B6] Yau, S. S. and Collofello, S., "Some stability measures for software maintenance," *IEEE Transactions of Software Engineering*, vol. SE-6, no. 6, pp. 545–552, Nov. 2001.

*This article proposes logical stability metrics for software maintenance such as those that result in propagation of change within modules and across module boundaries.*

*<Bibliography>  
Bibliographic entries begin with a B followed by a number in square brackets. Note that a B is used regardless of the annex letter identifier. See 19.1.*

*<T,Text> For annotated bibliographies, indent the explanatory notes and set them in italics. See 19.5.1.*

*In general, publications other than standards (journal articles, magazine articles, books) should be placed in the bibliography. For exceptions, see 10.4 and Clause 19.*

## **Annex C**

(informative)

### **Example amendment**

The following pages contain an example amendment. It contains the body of the amendment only. Please follow the instructions in Annex B for the title page, copyright information, and introduction.

For additional guidance on amendments, a presentation entitled “Amendment Tips and Tools” is available from the IEEE Standards Web site <<http://standards.ieee.org/guides/style/index.html>>.

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*The designation of an amendment to a base standard is structured so that the designation of the base precedes a lowercase letter. See 4.2.3.*

# IEEE P12345a/D1

## Draft Recommended Practice for Rating Structure for AC High-Voltage Circuit Breakers

### Amendment 1: Capacitance Current Switching

*The title of an amendment consists of the title of the base standard followed by the amendment title. The amendment title has the amendment number (e.g., Amendment 1) followed by a colon, then a short descriptive title for the changes to the document.*

NOTE—The editing instructions contained in this amendment define how to merge the material contained therein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed by using ~~striketrough~~ (to remove old material) and underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instruction. ***Replace*** is used to make changes in figures or equations by removing the existing figure or equation and replacing it with a new one. Editing instructions, change markings, and this NOTE will not be carried over into future editions because the changes will be incorporated into the base standard.

*This note explaining editing instructions for amendments or corrigenda shall be placed after the title of the standard in the main body of the document. See 21.1.*

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IEEE P12345a/D1, May 2008

## 1. Overview

*The editorial instructions are shown in bold italic. "Change" is used to alter existing text. "Delete" and then "Insert" shall not be used to implement a change. "Replace" is used only for figures and equations (not for text or tables). See 21.3.*

### 1.1 Scope

***Change the paragraph in 1.1 as shown:***

This recommended practice establishes a symmetrical current rating structure and construction recommendations for all indoor and outdoor types of ac high-voltage circuit breakers rated above 1000 V. Recommendations are also provided for capacitance current switching. ~~The recommended practice #~~ is only applicable to three-pole circuit breakers used in three-phase systems and ~~single-pole~~ circuit breakers used in single-phase systems. This recommended practice does not cover circuit breakers used at frequencies other than 50 Hz or 60 Hz, or generator circuit breakers that are covered in IEEE Std C37.013™-1997.

*Underscore is used to show inserted text and strikethrough is used for deleted text. See 21.3.*

## 2. Normative References

***Delete the following reference in Clause 2.***

IEEE Std 4™-1978, IEEE Standard Techniques for High-Voltage Testing.

***Insert the following reference alphabetically as it should appear in Clause 2:***

ANSI C37.06-2000, American National Standard AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis—Preferred Ratings and Related Required Capabilities.

## 4. Rated transient recovery voltage

### 4.1 General

***Delete the second paragraph in 4.1.***

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## 4.2 Rated TRV parameters

### 4.2.1 Circuit breakers rated below 100 kV

Replace Equation (1) in 4.2.1 with the following:

“Replace” shall only be used to change equations or figures. See 21.3.

$$E_2 = \frac{\sqrt{2}}{\sqrt{3}} VK_a K_f \quad (1)$$

Insert the following subclause after 5.3:

“Insert” includes new text, equations, tables, and/or figures into the standard. See 21.3.

## 5.4 Rated capacitance switching currents

### 5.4.1 General

Note that 5.4 is used as the subclause number because 5.3 is the last H2 head in Clause 5. If 5.4 had already existed, the subclause may be numbered 5.3A. See 21.2.

Capacitance switching currents may include part or all of the operating duty of a circuit breaker, such as the charging current of an unloaded transmission line or cable or the load current of a shunt capacitor bank.

The rating of a circuit breaker for capacitance current switching shall include, where applicable

- a) Rated line-charging breaking current applicable to all outdoor circuit breakers
- b) Rated cable-charging breaking current applicable to all indoor circuit breakers
- c) Rated single capacitor bank breaking current

### 5.4.2 Rated line-charging breaking current

The rated line-charging breaking current ( $I_l$ ) is the maximum line-charging current that the circuit breaker shall be capable of breaking at its rated voltage under the conditions of use and behavior prescribed in ANSI C37.06-2000. The specification of a rated line-charging breaking current is mandatory for all outdoor circuit breakers.

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# Annex A

(normative)

## Example Annex

### A.1 Mechanical loading

#### A.1.2 Circuit breaker

*If an amendment inserts a subclause between two existing subclauses in a base standard, an additional letter should be included in the head. See 21.2.*

*Insert the following subclause after A.1.2.1:*

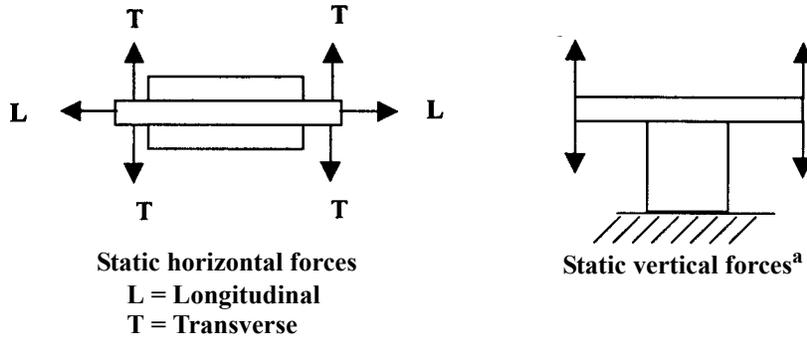
##### A.1.2.1a Ice loading

The circuit breaker shall be capable of withstanding ice loading caused by up to 20 mm of ice. This requirement is only applicable to outdoor circuit breakers.

#### A.1.3 Terminal loading

*Replace Figure A.1 with the following:*

*“Replace” shall only be used to change equations or figures. See 21.3.*



<sup>a</sup> Static vertical forces shown on grounded circuit breaker.

**Figure A.1—Direction of terminal mechanical loading forces**

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## Annex D

(informative)

### Sample permission letters for working groups

When previously copyrighted material is to be reprinted or modified for use in an IEEE standard, the working group should avoid any possible copyright infringement. The working group shall obtain clear, written permission from the copyright holder as early as possible in the process, but in no event later than submittal of the document for approval by the IEEE-SA Standards Board.

The following pages provide sample letters for requesting permission to reprint material from a previously copyrighted publication, as well as to modify copyrighted material. In each case, the first letter is to be completed by the working group chair or designated contact. This is the letter of request for permission to use the identified material. The second letter, which is to be completed by the copyright holder, grants the working group permission to use the material as requested. These permissions shall be obtained in writing on letterhead of the copyright holder.

NOTE—Copies of these letters may be found at

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<<http://www.standards.ieee.org/guides/style/annexD2.gif>>

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