

# Manual of Style for NFPA Technical Committee Documents

July 2004 Edition



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## Manual of Style

for

### NFPA Technical Committee Documents

#### 2004 Edition

This edition of the *Manual of Style* was prepared by NFPA staff and approved by the Standards Council on July 15, 2004. The 2004 edition of the *Manual of Style* supersedes all previous editions.

#### Origin and Development of the *Manual of Style*

The first edition of the *Manual of Style* was issued in 1972 and was primarily based upon *The Chicago Manual of Style*. The second edition, published in 1986, was an update and expansion of the 1972 edition, and again it was primarily based upon *The Chicago Manual of Style*.

The January 2000 edition of the *Manual of Style* was extensively revised, based on the ANSI/SES *Recommended Practice for Standards Designation and Organization*. The April 2000 edition of the *Manual of Style* incorporated changes to correct editorial errors and further clarify the requirements for definitions and notes.

The 2003 edition of the *Manual of Style* incorporated the following changes:

- Individual chapters are now permitted to contain administrative text in the first section (see Section 1.7).
- All definitions must appear in Chapter 3, but they are also permitted to appear in the administrative section of a chapter (see 1.6.3.2 and 1.6.3.5).
- Normative annexes are permitted to be used in codes and standards (see 1.9.6).
- Codes and standards are permitted to develop multiple design levels (see 2.2.3.3).
- Scope, Application, and Purpose statements are permitted to use statements of fact or mandatory language (see 2.3.1.5).
- Equations are numbered to correspond to the paragraph where they are referenced (see 3.3.4.2).

The 2004 edition of the *Manual of Style* incorporates the following changes:

- Requirements have been added to address the use of terms and definitions from outside (Non-NFPA) sources (see 2.3.2.12).
- Requirements have been added to ensure that where exceptions are rewritten as requirements they are worded to carry equal weight with other acceptable arrangements or requirements (see 2.2.1.2).
- Chapter 4, Units of Measurement has been completely rewritten to address the use of U.S. customary (inch pound) and metric (SI) units within NFPA documents. Chapter 4 now permits the TC/TCC to choose among the following three options when presenting units of measurement:
  - (1) SI units only
  - (2) SI units followed by U.S. customary units in parentheses
  - (3) U.S. customary units followed by SI units in parentheses

Additionally, the concepts of accuracy and precision have been introduced throughout Chapter 4 to provide guidance to the committees when converting between units to ensure that each value is accurate and precise as presented.

Many editorial changes have been incorporated in this edition to address style and formatting issues that will improve the uniformity of the documents and product compatibility. Other editorial material has been added to clarify requirements and to improve usability.

The following is a chronological summary of *Manual of Style* editions:

- 1st Edition — January 2000
- 2nd Edition — April 2000
- 3rd Edition — January 2003
- 4th Edition — July 2004

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# Manual of Style

for

## NFPA Technical Committee Documents

2004 Edition

### Chapter 1 Document Structure

**1.1 General.** Chapter 1 of the *Manual of Style* shall address the structure of NFPA Technical Committee documents in an outline arrangement and shall include the physical layout of the documents, numbering system, and chapter sequences.

#### 1.2 Document Types.

**1.2.1 Codes and Standards.** See also 2.3.1.

**1.2.1.1** The main text of a code or standard shall consist of all mandatory requirements.

**1.2.1.2** All nonmandatory or informational text shall appear either in Annex A or as a separate annex in the case of specialized information.

**1.2.2 Recommended Practices.** See also 2.4.1.

**1.2.2.1** The main text of recommended practices shall consist of recommendations and directly supporting text.

**1.2.2.2** All other informational text shall appear either in Annex A or as a separate annex in the case of specialized information.

**1.2.3 Guides.** Guides shall be permitted to mix recommendations and explanatory material in the body of the main text.

**1.3 Performance-Based Documents.** Performance-based documents that incorporate performance-based options in accordance with approaches outlined in *NFPA Primers for Performance-Based Documents* shall adhere to the requirements of the *Manual of Style* where applicable while maintaining the integrity of the performance-based approaches.

#### 1.4 Document Division.

**1.4.1 Chapters and Annexes.** Documents shall consist of several distinct chapters and annexes, which shall be further subdivided as required.

**1.4.2 Arrangement.** The document shall be arranged, in order of descending importance, into chapters, sections, subsections, paragraphs, and subparagraphs.

**1.4.3 Division Numbering.** All divisions shall be numbered in Arabic sequence (1, 2, 3, . . .).

#### 1.5 Front Matter.

**1.5.1** Document front matter shall only include objective, nontechnical information about the document and shall be prepared by NFPA staff independent of the consensus development process.

**1.5.2** NFPA documents shall contain the front matter components in the following order: cover, title page, committee list(s), table of contents, and introductory information.

##### 1.5.2.1 Cover.

**1.5.2.1.1** The front cover shall carry the NFPA numeric designation for the document; the title of the document — for example, *Standard for . . .*; the edition date; the NFPA logo; the words “NFPA, 1 Batterymarch Park, Quincy, MA USA, 02169-7471”; and the phrase “An International Codes and Standards Organization.”

**1.5.2.1.2** The inside of the front cover shall carry a general statement of where to obtain information on the document and a statement of the copyright and republishing rights.

**1.5.2.2 Title Page.** The title page shall carry the copyright notice and date, the full title of the document, the edition date, the date of action by the Association, the date of issue by the Standards Council, the effective date of the document, and an indication that it supersedes all previous editions if applicable.

**1.5.2.2.1** Documents that are approved by the American National Standards Institute (ANSI) shall have a statement to this effect with the date of approval.

**1.5.2.2.2** The title page shall also contain an origin and development statement.

**1.5.2.2.2.1** This statement shall be a comprehensive history of the document from its first edition, including the purposes, major changes in the various editions through the years, and any changes in the committee structure during these periods.

**1.5.2.2.2.2** All NFPA Technical Committee documents shall have an origin and development statement prepared by NFPA, independent of the consensus development process.

**1.5.2.2.2.3\*** A final sentence or paragraph shall be added to the origin and development statement outlining changes in the latest edition.

**1.5.2.2.2.4** The statement shall be modified as necessary in subsequent years to add new information.

**1.5.2.3 Committee List(s).** The page following the title page shall provide the committee list(s). The technical committee name shall be listed at the top of the page.

**1.5.2.3.1** The committee list shall include the names of all the persons who were committee members at the time of the final committee balloting of the specific edition of the document.

**1.5.2.3.1.1** This list shall include only those persons who were members of the technical committee at the time of balloting.

**1.5.2.3.1.2** It shall be the list published in the *Report on Comments* (ROC).

**1.5.2.3.1.3** If there is no ROC, it shall be the list published in the *Report on Proposals* (ROP).

**1.5.2.3.2** The list shall be organized by committee officers (chair and secretary); principal members and alternate members, with the principal listed with each alternate's name; and nonvoting members.

**1.5.2.3.2.1** This list shall include all member's companies and, if applicable, the organizations they represent, both of which shall be spelled out in full.

**1.5.2.3.2.2** The states or countries where the members reside and the designations of their committee membership classification as defined by NFPA shall be shown.

**1.5.2.3.3** When more than one technical committee is responsible for the document, all committees concerned shall be listed with an indication of the portion of the document for which each technical committee is responsible.

**1.5.2.3.4** Technical correlating committees shall be listed before the technical committee(s).

**1.5.2.3.5** The NFPA staff liaison assigned to the technical committee at the time of voting shall be included at the end of the committee list.

**1.5.2.3.6** Each committee list shall be followed by notes that read as follows:

*This list represents the membership at the time the Committee was balanced on the final text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of the document.*

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

**1.5.2.3.7\*** The technical committee scope shall be printed following the notes shown in 1.5.2.3.6.

#### **1.5.2.4 Table of Contents.**

**1.5.2.4.1** The table of contents shall start on the page following the committee list page(s).

**1.5.2.4.2** The table of contents shall itemize all chapter titles and section headings appearing in the document and the pages on which they start.

**1.5.2.4.3** To facilitate the compilation of the table of contents, the committee shall title each main (two-digit) section. (*See also 1.8.2.2.*)

#### **1.5.2.5 Introductory Information.**

**1.5.2.5.1** The first page of the document shall begin on the next full page following the end of the table of contents.

**1.5.2.5.2** The following information shall form the heading prior to Chapter 1, at the top of the first page, and shall appear in the following order:

- (1) Document number
- (2) Complete title
- (3) Edition of document
- (4) Important notice regarding legal disclaimers as follows:

IMPORTANT NOTE: This NFPA document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading "Important Notices and Disclaimers Concerning NFPA Documents." They can also be obtained on request from NFPA or viewed at [www.nfpa.org/disclaimers](http://www.nfpa.org/disclaimers).

- (5) Notice regarding asterisk as follows:

NOTICE: An asterisk (\*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

- (6)\* Notice regarding vertical rules and deletion bullets, where applicable, as follows:

Changes other than editorial are indicated by a vertical rule beside the paragraph, table, or figure in which the change occurred. These rules are included as an aid to the user in identifying changes from the previous edition. Where one or more complete paragraphs have been deleted, the deletion is indicated by a bullet (●) between the paragraphs that remain.

- (7)\* Notice regarding extracts, where applicable, as follows:

- (a) Use the following notice in a standard or code:

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for mandatory extracts are given in Chapter 2 and those for nonmandatory extracts are given in Annex \_\_\_\_\_. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

- (b) Use the following notice in a recommended practice:

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in the recommendations sections of this document are given in Chapter 2 and those for extracts in the informational sections are given in Annex \_\_\_\_\_. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text should be sent to the technical committee responsible for the source document.

- (c) Use the following notice in a guide:

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in advisory sections of this document are given in Chapter 2 and those for extracts in the informational sections are given in Annex \_\_\_\_\_. Editorial changes to extracted material consist of revising references to an appropriate division in this document or the inclusion of the document number with the division number when the reference is to the original document. Requests for interpretations or revisions of extracted text should be sent to the technical committee responsible for the source document.

- (8) Notice regarding referenced publications as follows:

Information on referenced publications can be found in Chapter 2 and Annex \_\_\_\_\_.

**1.6 Administrative Chapters.** The first three chapters of any document shall contain only administrative text and shall be in the following order:

Chapter 1 Administration (*See 1.6.1.*)

Chapter 2 Referenced Publications (*See 1.6.2.*)

Chapter 3 Definitions (*See 1.6.3.*)

### 1.6.1 Chapter 1 Administration.

**1.6.1.1 General.** Chapter 1 shall include the following sections, in this order, where applicable:

Scope (*See 1.6.1.2.*)

Purpose (*See 1.6.1.3.*)

Application (*See 1.6.1.4.*)

Retroactivity (*See 1.6.1.5.*)

Equivalency (*See 1.6.1.6.*)

Units and Formulas (*See 1.6.1.7.*)

Enforcement Requirement (*See 1.6.1.8.*)

#### 1.6.1.2\* Scope.

**1.6.1.2.1** The text of a document shall be required to start with a statement of the document's scope, which shall be within the scope of the committee as approved by the Standards Council in accordance with the *Regulations Governing Committee Projects*.

**1.6.1.2.2** The document scope shall describe in general terms what the document covers and shall include sufficient details to indicate the range or limits of what is covered.

**1.6.1.2.3** The document scope shall be permitted to include subsections on application and nonapplication.

#### 1.6.1.3\* Purpose.

**1.6.1.3.1** The text of a document shall be required to contain a document purpose section that describes the goal of the document.

**1.6.1.3.2** The document purpose shall also describe the objective(s) of the document or what it was created to accomplish.

**1.6.1.4\* Application.** The text of a document shall be permitted to contain an application section that shall indicate how and to what the requirements of the document shall apply.

**1.6.1.5\* Retroactivity.** Retroactivity statements shall be used as applicable.

**1.6.1.6\* Equivalency.** Equivalency statements shall be used as applicable.

**1.6.1.7 Units and Formulas.** An additional administrative section shall be permitted to be included and shall contain additional sections on units, formulas, and other specialized mathematical notations that apply to the document. (*See A.4.4.*)

#### 1.6.1.8 Enforcement Requirement.

**1.6.1.8.1\*** NFPA codes shall have the following wording within Chapter 1 to assist authorities in the enforcement of the code:

**1.X Enforcement.** This code shall be administered and enforced by the authority having jurisdiction designated by the governing authority. (*See Annex \_\_\_\_ for sample wording for enabling legislation.*)

**1.6.1.8.1.1** The code enforcement requirement shall be included in NFPA codes.

**1.6.1.8.1.2** The code enforcement requirement shall be permitted to be used in NFPA standards.

**1.6.1.8.2** NFPA codes or standards containing the code enforcement requirement shall have an annex showing sample wording for enabling legislation.

**1.6.1.9\* Additional Administrative Sections.** Additional administrative sections shall be permitted to be included in Chapter 1 as required by the technical committee.

### 1.6.2 Chapter 2 Referenced Publications.

**1.6.2.1** Chapter 2 shall only contain the referenced publications that apply to the document.

**1.6.2.2** Chapter 2 shall contain only mandatory referenced publications in codes and standards. (*See 2.3.1.2.*)

**1.6.2.3** A committee proposal (CP) shall be developed to update non-NFPA references at the ROP stage.

**1.6.2.4** Any references that are not mandatory but apply to the document shall be included in the last annex in codes and standards.

**1.6.2.5** Chapter 2 shall contain all references used in the recommendation part of the document in recommended practices. (*See 2.4.1.4.*)

**1.6.2.6** All references contained in annexes of a recommended practice shall appear in the last annex of a recommended practice.

**1.6.2.7** In guides that do not contain any annexes or that do not contain any references in the annexes, all references shall appear in Chapter 2. (*See 2.4.2.3.*)

**1.6.2.8** If there are no mandatory referenced publications in a code or a standard, or no referenced publications in a recommended practice or guide, then Chapter 2 shall be reserved.

### 1.6.3 Chapter 3 Definitions.

**1.6.3.1** Chapter 3 shall contain only definitions.

**1.6.3.2** All definitions contained within the document shall appear in Chapter 3.

**1.6.3.3** Chapter 3 shall include only terms used within the document.

**1.6.3.4** All definitions shall be numbered individually within Chapter 3. (*See 3.2.4.5.*)

**1.6.3.5** Definitions or a list of defined terms shall be permitted to be included in other chapters provided that they are also included in Chapter 3.

**1.6.3.5.1** Definitions or a list of defined terms included in a chapter other than Chapter 3 shall only appear in Section X.1. (*See 1.7.1.*)

**1.6.3.5.2\*** Definitions in a chapter other than Chapter 3 shall be in the form of subsections to Section X.1.

**1.6.3.5.3\*** A list of terms in a chapter other than Chapter 3 shall be in the form of a numbered list, carrying a cross-reference to the definitions in Chapter 3.

### 1.7 Individual Chapter Administrative Text.

**1.7.1\*** Each chapter starting with Chapter 4 shall be permitted to have the following administrative sections:

- (1) Chapter scope
- (2) Chapter application
- (3) Chapter purpose
- (4) Chapter definitions

**1.7.2\*** The administrative sections listed in 1.7.1 shall only be permitted to appear in Section X.1 of each chapter.

**1.8 Numbering System.** Mandatory text shall be divided into chapters that are numbered consecutively with Arabic numbers.

**1.8.1 Subdivisions.** All subdivisions shall contain at least two subdivisions (i.e., 3.1, 3.2 or 4.1.1, 4.1.2).

**1.8.2 Sections.** Mandatory text within chapters shall be further divided into sections that are numbered consecutively.

**1.8.2.1** Sections shall be numbered consecutively by adding a period (.) and an Arabic number after the chapter number (e.g., sections in Chapter 4 shall be numbered 4.1, 4.2, 4.3, etc.).

**1.8.2.2** All sections shall be titled.

**1.8.3 Subsections.** Sections containing multiple requirements shall be subdivided into subsections, which shall be further subdivided into paragraphs of text.

**1.8.3.1** Subsections shall be numbered consecutively by adding a period and an Arabic number to the section number (e.g., subsections in Section 4.2 shall be numbered 4.2.1, 4.2.2, 4.2.3, etc.).

**1.8.3.2** The use of titles for subsections shall be optional but consistent; that is, if one subsection within a section is to be titled, all subsections in that section shall also be titled.

**1.8.3.3\*** The use of titles for subsections shall be permitted to be inconsistent when the subsection has no requirement of its own but serves only as a title over two or more related paragraphs.

**1.8.4 Paragraphs and Subparagraphs.** Multiple requirements within subsections shall be treated as separate paragraphs and subparagraphs, which shall be permitted to be further broken down into sub-subparagraphs.

**1.8.4.1** Paragraphs shall be numbered by adding an additional period and consecutive Arabic numbers to the subsection number (e.g., 4.2.1.1, 4.2.1.2, etc.), with the option of using capital letters in parentheses if the paragraphs are not further broken down into subparagraphs.

**1.8.4.2** Subparagraphs shall be numbered by adding an additional period and consecutive Arabic numbers to the paragraph number (e.g., 4.2.1.1.1, 4.2.1.1.2, etc.), with the option of using capital letters in parentheses if they are not further broken down into sub-subparagraphs.

**1.8.4.3** Where the numbering of sub-subparagraphs using additional digits is necessary, the total number of digits, including the chapter number designator, shall not exceed six digits (e.g., 4.2.1.1.1.1), with the possibility of one additional division that is lettered [and that would be written in cross-references as 4.2.1.1.1.1(A)].

## 1.9 Annexes.

**1.9.1\*** Annexes shall be permitted to be added to a document to facilitate the use of the document; therefore, their relation to the document shall be clearly set forth.

**1.9.2** Annexes shall be within the scope of the project under which the document was developed, and they shall not be inconsistent with the document itself.

**1.9.3** An annex shall be processed in accordance with the *Regulations Governing Committee Projects*.

**1.9.4** Each annex shall begin with its own designation, title, and so forth.

**1.9.5** Annexes shall each be indicated as Normative (mandatory language) or Informative (nonmandatory language).

## 1.9.6 Normative Annexes.

**1.9.6.1** Normative annexes shall only be used for illustrative examples of language adoptable by the authority having jurisdiction and shall in all cases be approved by the Secretary of the Standards Council.

**1.9.6.2** Normative annexes shall contain the following boilerplate text indicating that they are not part of the document unless specifically adopted:

*This annex is not a part of the requirements of this NFPA document unless specifically adopted by the jurisdiction.*

**1.9.6.3** Normative annexes shall be self-contained and shall include applicable scopes, purposes, applications, definitions, and references as required.

**1.9.6.4** Normative annexes shall only be used in codes and standards.

**1.9.7 Informative Annexes.** Nonmandatory text shall be divided into annexes, beginning with Annex A, Explanatory Material, and ending with a final annex reserved for nonmandatory referenced publications, titled Informational References.

**1.9.7.1** An annex containing a cross-reference chart to a previous edition shall be permitted to be included for the convenience of the reader.

**1.9.7.2** When an annex containing a cross-reference chart to a previous edition is included, it shall follow the Informational References annex.

**1.9.8** The editorial statement prefacing Annex A, Explanatory Material, shall consist of the following:

*Annex A is not a part of the [requirements, recommendations] of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.*

**1.9.9** The editorial statement prefacing each informative annex (except Annex A) shall consist of the following:

*This annex is not part of the [requirements, recommendations] of this NFPA document but is included for informational purposes only.*

**1.9.10** An annex listing references for annex material, bibliographical publications, informative publications, and documents extracted in the definition and/or annexes shall be the last annex in standards and codes, and it shall be titled Informational References.

**1.9.10.1** The Informational References annex shall consist of three sections as follows:

(1) **X.1 Referenced Publications.** The following documents or portions thereof are referenced within this (*standard, code*) for informational purposes only and are thus not part of the requirements of this document unless also listed in Chapter 2.

(2) **X.2 Informational References.** The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

(3) **X.3 References for Extracts.** The following documents are listed here to provide reference information, including title and edition, for extracts given throughout the nonmandatory sections of this (*standard, code*) as indicated by a reference in brackets [] following a section or paragraph. These documents are not a part of the requirements of this document unless also listed in Chapter 2 for other reasons.

**1.9.10.2** If there are no Referenced Publications, no Informational References, or no References for Extracts, the corresponding section(s) shall be reserved.

**1.9.10.3** If there are no Informational References of any type, the entire annex shall be reserved.

**1.9.11** An annex listing references for annex material, bibliographical publications, informative publications, and documents extracted in the definitions and/or annexes shall be the last annex in recommended practices, and it shall be titled Informational References.

**1.9.11.1** The Informational References annex shall consist of three sections as follows:

- (1) **X.1 Referenced Publications.** The following documents or portions thereof are referenced within this *recommended practice* for informational purposes only and are thus not part of the recommendations of this document unless also listed in Chapter 2.
- (2) **X.2 Informational References.** The following documents or portions thereof are listed here as informational resources only. They are not a part of the *recommendations* of this document.
- (3) **X.3 References for Extracts.** The following documents are listed here to provide reference information, including title and edition, for extracts given in the informational sections of this *recommended practice* as indicated by a reference in brackets [] following a section or paragraph. These documents are not a part of the *recommendations* of this document unless also listed in Chapter 2 for other reasons.

**1.9.11.2** If there are no Referenced Publications, no Informational References, or no References for Extracts, the corresponding section(s) shall be reserved.

**1.9.11.3** If there are no Informational References of any type, the entire annex shall be reserved.

**1.9.12** An annex listing references for annex material, bibliographical publications, informative publications, and documents extracted in the definitions and/or annexes shall be the last annex in guides, and it shall be titled Informational References.

**1.9.12.1** The Informational References annex for guides shall consist of three sections as follows:

- (1) **X.1 Referenced Publications.** The following documents or portions thereof are referenced within the annexes of this guide.
- (2) **X.2 Informational References.** The following documents or portions thereof are listed here as informational resources only. They are not directly referenced in this guide.
- (3) **X.3 References for Extracts.** The following documents are listed here to provide reference information, including title and edition, for extracts given throughout the informational sections of this guide as indicated by a reference in brackets [] following a section or paragraph.

**1.9.12.2** If there are either no Referenced Publications, no Informational References, or no References for Extracts, the corresponding section(s) shall be reserved.

**1.9.12.3** If there are no Informational References of any type, the entire annex shall be reserved.

**1.10 Index.** All NFPA Technical Committee documents shall have an index that shall be prepared by NFPA independent of the consensus development process.

**1.11\* Codes and Standards Pages.** NFPA codes and standards development process information sheets shall be included at the end of the document when appropriate.

## Chapter 2 Technical Style

**2.1\* General.** Chapter 2 of this document shall address the technical style of the document and shall include the following:

- (1) Technical rules
- (2) Rules for mandatory documents
- (3) Rules for nonmandatory documents

### 2.2 Technical Rules.

#### 2.2.1 Permissive or Alternative Terms.

**2.2.1.1** The terms *may* and *may not* shall not be used in any portion of codes, standards, or recommended practices.

**2.2.1.2** The phrase *shall be permitted (to be)* shall be used to state a permitted use or an alternative to a specified requirement within codes and standards.

**2.2.1.3** The phrase *should be permitted (to be)* shall be used to state a recommended permitted use or a recommended alternative to a recommendation within recommended practices.

**2.2.1.4** The phrase *provided that* shall be permitted to be used as part of a permitted use or an alternative requirement within codes and standards or used as part of a recommendation within recommended practices.

#### 2.2.2\* Unenforceable Terms.

**2.2.2.1\*** The main text of codes and standards shall not contain references or requirements that are unenforceable and vague. (*See 2.3.3 and 2.3.4.*)

**2.2.2.2** Unenforceable terms shall be allowed in recommended practices and guides.

**2.2.2.3\*** The terms contained in Table 2.2.2.3 shall be reviewed in context, and if the resulting requirement is unenforceable or vague, they shall not be used within the body of codes or standards.

**2.2.2.4** The list of terms contained in Table 2.2.2.3 shall not be considered all-inclusive.

**2.2.2.5** All mandatory language shall be reviewed for usability, adoptability, and enforceability.

#### 2.2.3 Choices of Levels of Safety.

**2.2.3.1\*** Codes and standards shall state specific criteria that minimize the judgment required by the users.

**2.2.3.2\*** Multiple levels of safety shall not be used in any code or standard.



**Table 2.2.2.3 Possible Unenforceable and Vague Terms**

|                      |                |                 |
|----------------------|----------------|-----------------|
| Acceptable           | Frequent(ly)   | Practices       |
| Adequate(ly)         | Firmly         | Prefer(red)     |
| Appreciable          | Generally      | Proper(ly)      |
| Appropriate          | Good           | Ready(ily)      |
| Approximate(ly)      | Lightly        | Reasonable(ly)  |
| Available            | Likely         | Safe(ly) (ty)   |
| Avoid(ed)            | Legible(ly)    | Satisfactory    |
| Can                  | Many           | Secure(ly)      |
| Care                 | May            | Several         |
| Careful(ly)          | Maybe          | Should          |
| Consider(ed) (ation) | Might          | Significant     |
| Could                | Most(ly)       | Similar         |
| Desirable            | Near(ly)       | Some            |
| Easy(ily)            | Neat(ly)       | Substantial(ly) |
| Effectively          | Normal(ly)     | Sufficient(ly)  |
| Equivalent(ly)       | Note           | Suitable        |
| Familiar             | Periodic(ally) | Usual(ly)       |
| Feasible             | Practical(ly)  | Workmanlike     |
| Few                  |                |                 |

**2.2.3.3\* Multiple Design Levels.** Codes and standards shall be permitted to develop multiple design levels.

**2.2.4 Expressing Maximum and Minimum Limits.** Maximum and minimum limits shall be expressed with the following type of phraseology:

- (1) Shall not exceed 300 V to ground . . .
- (2) Shall have a clearance of not less than 5 cm . . .
- (3) Shall be supported at intervals not exceeding 1.5 m . . .

**2.2.5 Maintenance.** Where maintenance provisions are within the scope of a document, maintenance requirements shall be located in a separate section or chapter at the end of the main text of the document, independent of requirements for a new installation.

#### **2.2.6\* Product Standards.**

**2.2.6.1\*** Product standards shall be written such that the product is evaluated and tested for compliance with minimal or no judgmental decisions.

**2.2.6.2\*** Product standards shall always be separate documents from documents that contain user requirements.

#### **2.2.7 Related Hazards.**

**2.2.7.1\* When to Include Related Hazards.** In the event that a technical committee finds it necessary to include in a standard subjects that do not directly involve the intended application of the code or standard, the following shall be permitted to be included:

- (1) Subjects necessary for continuity of the contents of the standard and in concert with its scope
- (2) Material pertaining to related hazards where, for the application and enforcement of the code or standard, the technical committee is not able to separate it from specific hazards covered by the code or standard

**2.2.7.2\* NFPA Technical Advisory Committees.** When NFPA technical advisory committees (TACs) have been established or assigned for specific areas of expertise, advice shall be sought from the appropriate TAC.

#### **2.3 Rules for Mandatory Documents.**

**2.3.1 Codes and Standards.** See A.2.3.2.6 for the NFPA Official Definitions of these terms.

**2.3.1.1** Chapter 1 shall be written in mandatory language. (*See 2.3.1.5.*)

**2.3.1.2\*** Chapter 2 shall be written in mandatory language and shall include all mandatory referenced publications.

**2.3.1.2.1** Chapter 2 shall consist of three sections as follows:

- (1) **2.1 General.** The documents or portions thereof listed in this chapter are referenced within this (*standard, code*) and shall be considered part of the requirements of this document.
- (2) **2.2 NFPA Publications.**
- (3) **2.3 Other Publications.**

**2.3.1.2.2** If there are either no NFPA Publications or no Other Publications, the corresponding section shall be reserved.

**2.3.1.2.3** If there are no referenced publications, the whole chapter shall be reserved.

**2.3.1.2.4** All reference listings in Chapter 2 shall contain complete reference information [i.e., document number (if applicable), document title, and date of publication (if applicable)].

**2.3.1.2.5** References shall be permitted to be referred to throughout the document (other than Chapter 2) by only their numerical designation or document title, as used in the field.

**2.3.1.3\*** Section 3.1 of Chapter 3 shall be written in mandatory language. (*See 2.3.1.3.1.*)

**2.3.1.3.1** Chapter 3 shall consist of three sections as follows:

- (1) **3.1 General.**

**3.1.1** The definitions contained in this chapter shall apply to the terms used in this (*standard, code*).

**3.1.2** Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

- (2) **3.2 NFPA Official Definitions.**

- (3) **3.3 General Definitions.**

**2.3.1.3.2** If there are either no NFPA Official Definitions or no General Definitions, the corresponding section shall be reserved.

**2.3.1.3.3** If there are no definitions, the whole chapter shall be reserved.

**2.3.1.4** Definitions shall not be written in mandatory language. (*See 2.3.2.3.*)

**2.3.1.5** Scope, purpose, and application statements of Chapter 1 and of individual chapters shall be permitted to utilize statements of fact or mandatory language at the discretion of the technical committee but consistent language usage is preferred. (*See Section 1.7.*)

### 2.3.2 Definitions.

**2.3.2.1** A definition shall only describe the term being defined.

**2.3.2.2** Definitions shall be in the format of a bold term followed by the definition phrase to form a single paragraph unit.

**2.3.2.3** Definitions shall not contain requirements.

**2.3.2.4\*** References to other documents or sections of a document, notes, lists, footnotes, cautions, warnings, or figures shall not be permitted in definitions.

**2.3.2.5** Annex A material shall be permitted for any definition.

**2.3.2.6\*** Existing official definitions contained in the *Regulations Governing Committee Projects* shall be used where applicable.

**2.3.2.7\*** Existing general definitions contained in the NFPA *Glossary of Terms* shall be used where technically accurate and correct.

**2.3.2.8** Modifications to official definitions appearing in the *Regulations Governing Committee Projects* shall be submitted to the Standards Council.

**2.3.2.9** Modifications to terms appearing in the *Glossary of Terms* shall be submitted as a proposal processed in accordance with the *Regulations Governing Committee Projects*.

**2.3.2.10\*** Where an existing preferred definition is taken from another document or from the *Glossary of Terms*, the source document and year of publication shall be referenced in brackets at the end of the definition to indicate that the definition has been extracted from that document, e.g., [58, 2004].

**2.3.2.11** Modifications to terms followed by an extract citation shall be submitted as a proposal to the committee responsible for the source document in accordance with the *Regulations Governing Committee Projects*.

### 2.3.3 Mandatory Requirements.

**2.3.3.1** Where a sentence in a code or standard does not contain a mandatory requirement, it shall be rewritten to include a mandatory requirement or the sentence shall be moved to Annex A or deleted.

**2.3.3.2** The terms *shall* and *shall not* shall be used to indicate mandatory requirements.

**2.3.3.3\*** Figures and tables shall be permitted to appear in the mandatory section of a code and standard only when they are referenced using mandatory language. (See 3.7.1.1.)

### 2.3.4 Annexes.

**2.3.4.1** The annexes of codes and standards shall be used for advisory text, explanatory material, and supplementary information and shall not be used for mandatory requirements.

**2.3.4.2** All nonmandatory or informational text shall either appear in Annex A or be presented as a separate annex in the case of specialized information.

**2.3.4.3** The term *shall* shall not be used in the annexes because its use would indicate a mandatory action or requirement.

**2.3.4.4** Use of the terms *should*, *can*, *could*, and *might* shall be permitted in the annexes.

### 2.3.5 Exceptions.

**2.3.5.1** Exceptions shall be permitted only where the exception represents an allowance or required alternate procedure to a general rule when limited, specified conditions apply.

**2.3.5.2\*** Where the rewording of exceptions as requirements or removal of exceptions will not change the technical requirements of the document, exceptions shall be reworded as requirements or removed.

**2.3.5.3** Exceptions shall not be permitted to be used in place of several multiple requirements where the intent is to break up long sentences that incorporate a single rule that applies generally.

**2.3.5.4** Exceptions shall not be permitted to be used where the exception covers the predominate use or application and would more appropriately be addressed as a requirement.

**2.3.5.5\*** Exceptions shall not be used where there is a long list of exceptions indicating that the basic rule is often inapplicable.

### 2.3.6 Notes.

**2.3.6.1** Notes shall not be permitted to be used in the mandatory text sections of a document.

**2.3.6.2** Notes shall only be permitted to be used in tables and figures.

**2.3.6.3** Table and figure notes shall not include requirements.

**2.3.6.3.1** Cross-references to text sections containing mandatory requirements shall be permitted in table and figure notes.

**2.3.6.3.2** In table and figure notes, cross-references to mandatory text sections shall not be written in mandatory language.

### 2.3.7 Footnotes.

**2.3.7.1** Footnotes shall not be permitted to be used in the mandatory text sections of a document.

**2.3.7.2** Footnotes shall only be permitted to be used as table footnotes.

### 2.3.8\* Caution and Warning Statements.

**2.3.8.1** Caution and warning statements shall be provided to prevent injuries, damage, or other direct hazards to the user or exposures.

**2.3.8.2** Caution and warning statements shall only be permitted to be used within the mandatory text sections where a distinct hazard to the user, building, property, exposures, and so forth exists.

### 2.3.9 Cross-References.

**2.3.9.1\*** Mandatory cross-references shall be to specific mandatory requirements in other sections of the document and shall be stated in mandatory language.

**2.3.9.2\*** Nonmandatory cross-references to other sections, annexes, tables, or figures shall be permitted within mandatory text, but shall only be permitted where the cross-reference is to other portions of the document.

**2.3.9.3** Cross-references to subdivisions in other documents shall be permitted within the mandatory text of a document only when the reference is written in mandatory language.

**2.3.9.4** A cross-reference shall not be made to an entire chapter unless a cross-reference to one or more sections would not be complete.

**2.3.9.5** A cross-reference shall be made to an entire section, where all of the cross-referenced section is applicable and relevant.

### **2.3.10 References.**

**2.3.10.1\*** References to other documents within the mandatory text of a code or standard shall be mandatory.

**2.3.10.2** Nonmandatory references to other documents shall only be permitted within annexes.

**2.3.10.3** Recommended practices and guides shall not be referenced in the mandatory text of a document.

## **2.4 Rules for Nonmandatory Documents.**

**2.4.1 Recommended Practices.** See A.2.3.2.6 for the NFPA Official Definition of this term.

**2.4.1.1** A document that is a recommended practice shall include only recommendations and directly supporting text throughout the text. (*See 1.2.2.*)

**2.4.1.2** Where a sentence does not contain a recommendation, it shall be rewritten to include a recommendation or the sentence shall be moved to the annex.

**2.4.1.3** Mandatory language shall not be used in recommended practices.

**2.4.1.4** Chapter 2 shall include all publications referenced in the recommendations of the document.

**2.4.1.4.1** Chapter 2 shall consist of three sections as follows:

- (1) **2.1 General.** The documents or portions thereof listed in this chapter are referenced within this recommended practice and should be considered part of the recommendations of this document.
- (2) **2.2 NFPA Publications.**
- (3) **2.3 Other Publications.**

**2.4.1.4.2** If there are either no NFPA Publications or no Other Publications, the corresponding section shall be reserved.

**2.4.1.4.3** If there are no referenced publications, the whole chapter shall be reserved.

**2.4.1.4.4** All reference listings in Chapter 2 shall contain complete reference information [i.e., document number (if applicable), document title, and date of publication (if applicable)].

**2.4.1.4.5** References shall be permitted to be referred to throughout the document (other than Chapter 2) by only their numerical designation or document title, as used in the field.

**2.4.1.5** Chapter 3 of a recommended practice shall not contain mandatory language.

**2.4.1.5.1** Chapter 3 of a recommended practice shall consist of three sections as follows:

- (1) **3.1 General.**

**3.1.1** The definitions contained in this chapter apply to the terms used in this recommended practice.

**3.1.2** Where terms are not defined in this chapter or within another chapter, they should be defined using their ordinarily accepted meanings within the context in which they are used. *Webster's Collegiate Dictionary*, 11th edition, is the source for the ordinarily accepted meaning.

- (2) **3.2 NFPA Official Definitions.**

- (3) **3.3 General Definitions.**

**2.4.1.5.2** If there are no NFPA Official Definitions or no General Definitions, the corresponding section shall be reserved.

**2.4.1.5.3** If there are no definitions, the whole chapter shall be reserved.

**2.4.1.6** All informational text shall either appear in Annex A or be presented as a separate annex in the case of specialized information.

**2.4.2 Guides.** See A.2.3.2.6 for the NFPA Official Definition of this term.

**2.4.2.1** A document that is a guide shall be permitted to mix recommendations and explanatory material throughout the text.

**2.4.2.2** The term *shall* shall not be used in guides.

**2.4.2.3** Chapter 2 shall include all publications referenced in the main part of the guide.

**2.4.2.3.1** Chapter 2 shall consist of three sections as follows:

- (1) **2.1 General.** The documents or portions thereof listed in this chapter are referenced within this guide.
- (2) **2.2 NFPA Publications.**
- (3) **2.3 Other Publications.**

**2.4.2.3.2** If there are either no NFPA Publications or no Other Publications, the corresponding section shall be reserved.

**2.4.2.3.3** If there are no referenced publications, the whole chapter shall be reserved.

**2.4.2.4** Terms such as *can*, *could*, and *might* shall be permitted to be used in the text and in the annexes of guides in place of or in addition to the term *should*.

## **2.5 Internationalization of Documents.**

### **2.5.1 General.**

**2.5.1.1\*** Documents shall be written to enhance their international acceptability and adoptability.

**2.5.1.2\*** Where documents reference other codes, standards, or test methods, the referenced document, when available, shall be internationally recognized.

**2.5.2 Word Clarity.** Words and terms used in NFPA documents shall be selected for specificity and clarity in meaning, and use of jargon, limited-use or industrial-specific terms, or colloquial language that is difficult to understand or interpret shall be avoided.

**2.5.3 Multiple Meanings.** All words and terms used in NFPA documents that could be used, understood, or interpreted in more than one way shall be defined in the definitions chapter.

### **2.6\* Extracts.**

**2.6.1 General Extract Requirements.** To extract material from another NFPA document, all of the following items shall be required:

- (1) There shall be specific technical reasons for the extract.
- (2) There shall be clear indication, with the extracted text, of the number, title, and edition of the document from which the extracts are taken and that requests for interpretations or proposed revisions of the text shall be referred to the committee responsible for the source document.
- (3) Any editing of the extracted text shall be confined only to making the style consistent with that of the document containing the extract.
- (4) The extracted text shall be kept current with that of the source document in a timely, appropriate manner.

**2.6.1.1\*** Each paragraph, table, and figure extracted from another NFPA document shall be followed by a reference in brackets containing the document number in bold type followed by a colon and the reference section from the originating NFPA document, e.g., [10:2.3.2.5].

**2.6.1.2** A boilerplate paragraph shall be added at the beginning of the document to explain that material has been extracted from the document referenced in brackets at the end of a paragraph or section. [See 1.5.2.5.2(7).]

**2.6.1.3** Only mandatory text shall be extracted in mandatory sections of a code or standard, and the extracted material shall be taken from the current edition of the source document.

**2.6.1.4** When material is extracted from another document in the body of a code, standard, recommended practice, or guide, the complete title and the current edition of the source document shall be referenced in Chapter 2, Referenced Publications.

**2.6.1.5** A definition extracted from another NFPA document shall be cited as an extract, with the source document listed in the References for Extracts section of the Informational References annex. (See 1.9.10 and 1.9.11.)

**2.6.1.6** Source documents for extracts in annexes shall be listed in the References for Extracts section of the Informational References annex. (See 1.9.10 and 1.9.11.)

**2.6.1.7** Even when an entire annex consists of text extracted from another NFPA document, each paragraph, table, and figure shall carry the bracketed citation.

## **2.6.2 Extracted Material.**

**2.6.2.1** A section or paragraph being extracted from another document shall represent a specific thought and shall be entirely extracted.

**2.6.2.2** The context of the original extracted material shall not be compromised or violated. [See 2.6.1(3).]

### **2.6.2.3 Exception, Caution, and Warning Statements.**

**2.6.2.3.1** Text shall not be extracted without including any exception(s) associated with the extracted text.

**2.6.2.3.2** Similarly, caution and warning statements shall also be included.

### **2.6.2.4 Related Notes and Annex Material.**

**2.6.2.4.1** Notes and annexes are intended as advisory, supplementary information, and thus they shall not be required to be included along with an extracted paragraph.

**2.6.2.4.2** If, in the originating document, the extracted text contains notes or is associated with annex material, the committee shall review the notes and annexes.

**2.6.2.4.3** If the committee chooses not to extract the note or related annex section, they shall ensure that the paragraph cannot be misinterpreted based on the absence of this supplemental information.

## **2.6.3 Paragraph Numbering.**

**2.6.3.1\*** Committees shall not change the relationship of paragraphs to each other in renumbering extracted text.

**2.6.3.2** The committee taking the extract shall not take part of a section or paragraph and skip another part of this same section or paragraph without a valid technical reason.

**2.6.3.3** The family of paragraphs that state a set of requirements shall be kept together to ensure both documents are consistent in stated requirements.

**2.6.4 Cross-References.** Where extracted cross-material references another paragraph in the document from where the material is extracted, the committee shall try to extract the cross-referenced paragraph as well so its document is more complete and user-friendly.

## **Chapter 3 Editorial Style**

**3.1\* General.** Editorial style shall focus on the grammatical format used throughout the document.

### **3.2 Text Editorial Rules.**

#### **3.2.1 General.**

**3.2.1.1** Style, including grammar, punctuation, and conventional presentation of text, shall generally conform to the recommendations of *The Chicago Manual of Style*, 14th edition.

**3.2.1.2** Spelling and definitions of general words and terms shall follow *Webster's Collegiate Dictionary*, 11th edition.

#### **3.2.2 Spelling.**

**3.2.2.1\*** When a choice of spelling is given in *Webster's*, the simpler form shall be used in NFPA documents.

**3.2.2.2** Specific fire-related terminology shall have the spellings and meanings as set forth in the NFPA *Glossary of Terms*.

**3.2.2.3** When a standard definition is needed, *Webster's* shall be utilized where the meaning is correct and accurate as used in NFPA documents.

#### **3.2.3 Capitalization.**

**3.2.3.1 General.** Capitalization shall follow conventional usage, including the capitalization of proper names.

**3.2.3.2\* Titles.** The first letter of *chapter*, *section*, *figure*, and similar designations shall be capitalized only when the reference is specific.

**3.2.3.3\* Terms.** Terms such as *grade*, *class*, *specimen*, and *type* shall also be capitalized when the reference is specific.

#### **3.2.3.4 Figure Captions.**

**3.2.3.4.1** The first letter of each word of a figure caption shall be capitalized.

**3.2.3.4.2** A preposition of four letters or less (with, from), article (an, the), or coordinating conjunction (and, but, of) shall be lowercased unless it is the first or last word.

### **3.2.3.5 Table Titles.**

**3.2.3.5.1** The first letter of each word of a table title shall be capitalized.

**3.2.3.5.2** A preposition of four letters or less (with, from), article (an, the), or coordinating conjunction (and, but, of) shall be lowercased unless it is the first or last word. (*See 3.2.6.1.*)

### **3.2.3.6 Art Labels.**

**3.2.3.6.1** Only the first letter of the first word of labels within a figure shall be capitalized.

**3.2.3.6.2\*** Where labels begin with a unit of measure, no capitalization shall be used.

### **3.2.3.7 Text Headings.**

**3.2.3.7.1** The first letter of each word in text headings shall be capitalized.

**3.2.3.7.2** In text headings, a preposition of four letters or less (with, from), article (an, the), or coordinating conjunction (and, but, of) shall be lowercased unless it is the first or last word.

**3.2.3.7.3** The first letter of both parts of a hyphenated word shall be capitalized.

## **3.2.4 Definitions.**

**3.2.4.1 General.** All definitions for terms in the document shall appear in Chapter 3.

### **3.2.4.1.1 Defined Terms in Other Chapters.**

**3.2.4.1.1.1** At the committee's discretion, lists of defined terms shall be permitted to be given in other chapters in Section X.1 with cross-references added to each term to indicate the section where the definition can be found in Chapter 3. (*See 1.6.3.5.3.*)

**3.2.4.1.1.2** Complete definitions shall also be permitted to be given in other chapters in Section X.1 provided that the definitions also appear in Chapter 3. (*See 1.6.3.5.2.*)

**3.2.4.1.2** Chapter 3 shall contain only definitions for terms used in the document.

**3.2.4.1.3** Chapter 3 shall be divided into at least three sections.

**3.2.4.1.3.1** The first section in Chapter 3 shall be entitled General and shall contain the text of the boilerplate identified in 2.3.1.3.1.

**3.2.4.1.3.2** All applicable official definitions shall be listed in Section 3.2 under the heading NFPA Official Definitions.

**3.2.4.1.3.3\*** All general definitions for the document shall be listed in Section 3.3 under the heading General Definitions.

**3.2.4.1.3.4** Where specialized groupings of definitions are needed, these groupings shall be listed in subsequent sections under an appropriate heading (e.g., 3.4 Sprinkler-Related Definitions).

**3.2.4.2 Types of Entries.** All definitions within the sections of Chapter 3 shall be divided into main entries and up to two levels of subentries.

**3.2.4.2.1** Main definition entries shall consist of either of the following:

- (1) A primary noun that groups sets of subentries (e.g., *wall* is a main entry that groups subentries such as *angle wall*, *fire wall*, *non-load-bearing wall*)
- (2) An individual noun or a noun/modifier combination that is not part of a set for the document (e.g., *bulkhead*, *bulkhead panel*, *bulkhead wall* are all individual main entries)

**3.2.4.2.2** Subentry definitions shall consist of terms that define specific types of main entries (e.g., *maximum pressure* and *minimum pressure* are subentries that define types of the main entry *pressure*).

**3.2.4.2.3\*** Sub-subentries shall consist of terms that define types of subentries.

### **3.2.4.3 Defining Entries.**

**3.2.4.3.1** Where a term is defined, the definition shall be written in accordance with the rules for definitions in 2.3.2.

**3.2.4.3.2\*** Where main entries consist of a primary noun (e.g., *wall* or *pressure*) that serves to group sets of related subentry definitions, the noun shall not be required to carry a definition.

**3.2.4.3.3** All subentries and sub-subentries shall carry a definition written in accordance with the rules for definitions in 2.3.2.

**3.2.4.4 Alphabetizing Entries.** All definitions shall be listed in Chapter 3 in alphabetical order.

**3.2.4.4.1** All main definition entries shall be arranged alphabetically within each section using the word-by-word system.

**3.2.4.4.2\*** All subentry definitions within a grouping shall be arranged alphabetically under the main entry definition using the word-by-word system.

**3.2.4.4.3** All sub-subentry definitions within a grouping shall be arranged alphabetically under the subentry definition using the word-by-word system.

**3.2.4.5 Numbering Entries.** All definitions shall be numbered.

**3.2.4.5.1** All main definition entries shall be numbered consecutively by adding periods and consecutive Arabic numbers to the section number.

**3.2.4.5.2** All subentries shall be numbered by adding periods and consecutive Arabic numbers to the main definition number.

**3.2.4.5.3\*** All sub-subentries shall be numbered by adding periods and consecutive Arabic numbers to the subentry number.

**3.2.5 Abbreviations.** Accepted editorial practices of specialized publications in the specific technical field shall be used as a guide to abbreviations.

### **3.2.5.1 Acronyms and Uncommon Abbreviations.**

**3.2.5.1.1** All acronyms and any abbreviations that are not in common use shall be spelled out with the acronym or abbreviation following in parentheses for the first use of the term in the document.

**3.2.5.1.2** Each subsequent use shall be the acronym or abbreviation only.

**3.2.5.2 Units of Measure.** When accompanied by a specific quantity, all units of measure shall be abbreviated, except for units of time, which shall be spelled out.

**3.2.6 Punctuation.** Punctuation shall follow conventional usage as set forth in *The Chicago Manual of Style*.

**3.2.6.1 Use of Periods with Titles and Headings.** Periods shall not be used after the main title of a document, after chapter titles, or at the end of table titles.

**3.2.6.2 Use of Periods with Figure Captions.** Periods shall be used at the end of figure captions.

**3.2.6.3 Use of Periods with Section Headings.** Periods shall be used at the end of each section, subsection, and paragraph heading.

**3.2.6.4 Use of Periods with Abbreviations.** Periods shall not be used in abbreviations of units of measure unless the omission of the period could cause confusion (e.g., in., not in, for inch).

### 3.3 Document Structure Editorial Rules.

#### 3.3.1 Listed Items.

##### 3.3.1.1 List Placement.

**3.3.1.1.1\*** Lists shall be within the body of an existing paragraph and shall be preceded by introductory text and a colon.

**3.3.1.1.2\*** Lists shall not be permitted to be within the middle of a sentence.

##### 3.3.1.2 Style of Lists.

**3.3.1.2.1** The structure of all items within a list shall be parallel — that is, the items shall be all single words, all phrases, or all full sentences.

**3.3.1.2.2** In lists consisting of single words and phrases, the introductory text shall include mandatory language that establishes the requirement for the paragraph.

**3.3.1.2.3\*** In sentence-style lists, introductory text shall contain mandatory language if each item is not stated as a requirement.

**3.3.1.2.4** In sentence-style lists, each item shall consist of only one sentence.

##### 3.3.1.3 Types of Lists.

**3.3.1.3.1** Main lists shall be a grouping of listed items within a numbered or lettered section.

**3.3.1.3.2\*** Sublists shall be a grouping of listed items within a main list item.

**3.3.1.3.3** Sub-sublists shall be a grouping of listed items within a sublist item.

**3.3.1.4 Numbering.** The hierarchy for numbering and lettering listed items shall be as follows:

- (1) Main list item
  - (a) Sublist item
  - (b) Sublist item
    - i. Sub-sublist item
    - ii. Sub-sublist item
- (2) Main list item

**3.3.1.5 Unnumbered Lists.** Unnumbered lists, in which the items have no means for being cross-referenced, shall not be permitted.

**3.3.2 Figures.** See also 3.7.1.1.1 and 3.7.1.1.2.

**3.3.2.1** All figures shall be numbered and cross-referenced within the appropriate section, subsection, or paragraph of text.

**3.3.2.2** Numbering shall correspond to the section, subsection, or paragraph in which the figure is cross-referenced (e.g., Figure 4.3.2.2).

**3.3.3 Tables.** See also 3.7.2.

**3.3.3.1** Tables shall be numbered and cross-referenced within the appropriate section, subsection, or paragraph of text.

**3.3.3.2** Numbering shall correspond to the section, subsection, or paragraph in which the table is cross-referenced (e.g., Table 4.3.3.2).

**3.3.4 Equations.** See also 3.7.3.

**3.3.4.1** Equations shall be numbered only when necessary for cross-referencing purposes.

**3.3.4.2\*** Equation numbers shall correspond to the section, subsection, or paragraph in which the equation is cross-referenced, e.g., (4.3.4.2).

**3.3.4.3** If two or more equations appear in the same section, they shall also be lettered, e.g., (5.5.1a) and (5.5.1b).

**3.3.4.4** Equation numbers shall be in parentheses and shall appear to the right of the equation. (*See A.3.3.4.2.*)

### 3.4 Material from Other Organizations.

**3.4.1 Permission to Use.** To use material from other organizations in the text of an NFPA document, NFPA shall have written permission of the organization from which the material was obtained.

**3.4.2\* Staff Responsibility.** The NFPA staff liaison shall be responsible for obtaining written permission for use of materials from other organizations.

**3.4.3 Credit Line.** A credit line within the text and a reference citation in the appropriate reference chapter or annex shall be provided to acknowledge the owner/copyright holder of the material.

### 3.5 Explanatory Information.

**3.5.1** Explanatory statements that do not contain requirements shall not be used in the main text.

**3.5.2** Such material shall be located in an annex. (*See 2.3.4.*)

### 3.6 References.

#### 3.6.1\* Cross-References.

**3.6.1.1 Cross-References to Other Sections.** Cross-references to other sections within the document shall be specific and relevant and shall be placed where most relevant in the paragraph.

**3.6.1.1.1\*** A cross-reference to a chapter or section shall include the word Chapter or Section in the text.

**3.6.1.1.2** A cross-reference shall not be required to include “of this standard.”

**3.6.1.1.3\*** A cross-reference to a subdivision within a section shall be referred to by number only, without the word subsection or paragraph, except when the cross-reference begins the sentence.

**3.6.1.1.4\*** Nonmandatory cross-references to other sections, annexes, tables, or figures within a document shall be separated from the mandatory text by parentheses and shall be set in italic type.

### **3.6.1.2 Cross-References to Figures and Tables.**

**3.6.1.2.1** Cross-references to figures and tables shall be made using the applicable number prefaced by the word Figure or Table.

**3.6.1.2.2** When cross-reference is made to two or more figures or tables, the word Figure or Table shall be repeated before each number (e.g., Table 4.2.1 and Table 4.2.2).

**3.6.1.2.3** When cross-reference is made to a range of figures or tables, the word Figure or Table shall be repeated before each number in the range [e.g., Figure 4.4.2(a) through Figure 4.4.2(e)].

**3.6.1.3\*** **Unneeded Cross-References.** Cross-references shall not be used where additional words serve the same purpose.

**3.6.2 References to Publications.** The following rules shall apply to references to publications in the text of a document:

- (1) References to publications in the text shall be for the purpose of supplementing requirements, recommendations, and guidance (as in guides).
- (2) In codes and standards, only mandatory references shall appear in the text of the document. (See 1.6.2.2.)
- (3) Bibliographical and informative references shall not be included in the text of a document but only in explanatory material, such as in an annex or in a table footnote.

**3.6.2.1 References to Other NFPA Codes and Standards.** All references to other NFPA codes and standards shall include the NFPA designation followed by a comma and the full title of the document in italics (e.g., “. . . as required by NFPA 13, *Standard for the Installation of Sprinkler Systems*”).

**3.6.2.1.1** NFPA references shall be permitted to be referred to throughout the document (other than Chapter 2 or the last annex) by only their numerical designation or document title, as used in the field. (See 2.3.1.2.5.)

**3.6.2.1.2** The edition shall not be designated in the text, but in Chapter 2 or the last annex.

**3.6.2.2\*** **References to Proprietary Documents of Other Organizations.** All references to documents published by other organizations, including government entities, shall carry that organization’s designation and the full publication title in italics (e.g., “. . . in accordance with API 2510, *Design and Construction of LP-Gas Installations*”).

**3.6.2.2.1** References to documents published by other organizations shall be permitted to be referred to throughout the document (other than Chapter 2 or the last annex) by only their numerical designation or document title, as used in the field. (See 2.3.1.2.5.)

**3.6.2.2.2** The edition shall not be designated in the text, but in Chapter 2 or the last annex.

**3.6.2.3 References to Books, Reports, and Articles in Periodicals.** All references to books shall be made using the author-date method of citation (e.g., the author’s last name, or publishing organization if no author is given, and the year of publication enclosed in parentheses at the end of a sentence).

**3.6.3 Reference Lists.** The specific identification of referenced publications and their source shall be included in the list of mandatory referenced publications given in Chapter 2 or in the list of nonmandatory references given in the last annex. (See also 1.6.2, 1.9.10, 1.9.11, 2.3.1.2, 2.4.1.4, and 2.4.2.3.)

**3.6.3.1 NFPA Codes and Standards and Proprietary Documents of Other Organizations.** Mandatory references in Chapter 2 and informative references in the last annex shall include the identification number if any; the title; the year of the current edition (in Chapter 2) or the referenced edition (in annex references only); and the name and address of the organization issuing the referenced document.

**3.6.3.1.1\*** The current, approved edition of the referenced document shall be included in Chapter 2, Referenced Publications, for mandatory references or in the last annex, Informational References, for informative references.

**3.6.3.1.2** The referenced edition of the referenced document shall be included in the last annex, Informational References, for informative references.

**3.6.3.1.3** Updates of references to non-NFPA documents shall be completed by the appropriate technical committee and shall be processed in accordance with the *Regulations Governing Committee Projects*. (See 1.6.2.3.)

**3.6.3.1.4** The references shall be listed separately to facilitate updating to the latest edition by the user.

### **3.6.3.2 Books, Reports, and Articles in Periodicals.**

**3.6.3.2.1** Citations for books, reports, and periodicals shall include the author’s name (or the publishing organization if no author is identified), the year published, the full title of the work, the publisher’s city, and the full name of the publisher.

**3.6.3.2.2** The style for citations of books, reports, and periodicals shall conform to *The Chicago Manual of Style*, 14th edition.

## **3.7 Special Elements.**

**3.7.1 Figures.** See also 3.3.2.1 and 3.3.2.2.

### **3.7.1.1 General.**

**3.7.1.1.1** Figures in the main text of the document shall portray mandatory requirements.

**3.7.1.1.2** Drawings, charts, or graphs used to illustrate only a typical situation and not a mandatory requirement shall be placed in an annex.

**3.7.1.2 Preparation.** Drawings, charts, and graphs shall be prepared by NFPA from drawings submitted by the technical committee.

### **3.7.1.3 Identification.**

**3.7.1.3.1** Each drawing, chart, or graph shall be identified by a figure number and a unique caption.

**3.7.1.3.2** All figures shall be referenced in the text and the figure number shall be the same number as the section, subsection, or paragraph where it is referenced in the text.

**3.7.1.3.3** If more than one figure is related to a single section, subsection, or paragraph, lowercase letters in parentheses shall be used as a suffix to the paragraph number.

**3.7.1.3.4** The caption of the figure shall appear below the figure. (See 3.2.3.4.)

**3.7.1.4 Figure Position in Text.** When used in the text, a figure shall be placed as near to its first reference in the text as convenient.

**3.7.1.5 Figure Labels.** See also 3.2.3.6.

**3.7.1.5.1** All significant elements in a figure shall be labeled with terminology that matches the text discussion.

**3.7.1.5.2** All dimensions shall be indicated with SI units or with inch-pound units.

**3.7.1.5.2.1** Conversions to either inch-pound units or SI units shall be permitted to be given in parentheses following the primary unit when space permits.

**3.7.1.5.2.2** If there is not enough space in the figure, the conversion factor(s) shall be given in a figure note.

**3.7.1.5.3** Units of measure used in figure labels shall be abbreviated.

**3.7.1.6 Figure Legends or Notes.** Symbols in complex figures shall be identified in a legend or note.

**3.7.1.7\* Credit Lines.** Photos and artwork obtained from outside sources shall be identified by a credit line in parentheses following the caption.

**3.7.2 Tables.** See also 3.3.3.

**3.7.2.1 Identification.**

**3.7.2.1.1** Each table shall be identified by a number and a unique title.

**3.7.2.1.2** All tables shall be referenced in the text, and the table number shall be the same number as the section, subsection, or paragraph where it is referenced in the text.

**3.7.2.1.3** If more than one table is related to a single section, subsection, or paragraph, lowercase letters in parentheses shall be used as a suffix to the subdivision number.

**3.7.2.2 Titles.**

**3.7.2.2.1** The first letter of each word in a table title shall be capitalized.

**3.7.2.2.2** In a table title, a preposition of four letters or less, an article, or a coordinating conjunction shall be lowercased unless it is the first word.

**3.7.2.2.3** Each table shall have a unique title.

**3.7.2.3 Column Headings.**

**3.7.2.3.1** The first letter of each word in a column heading shall be capitalized.

**3.7.2.3.2** In a column heading, a preposition of four letters or less, an article, or a coordinating conjunction shall be lowercased unless it is the first word.

**3.7.2.3.3** Abbreviated units of measure in column headings shall be lowercased and enclosed in parentheses, unless the units of measure appear under a rule in which case they shall be lowercased but not enclosed in parentheses.

**3.7.2.3.4** The first letter of every word in column sub-headings shall be capitalized except for any dimensional heading at the top of each column.

**3.7.2.4 Column Entries.** Only the first letter of the first word of individual table entries shall be capitalized.

**3.7.2.5 Abbreviations and Letter Symbols.** Abbreviations and letter symbols for units, when the intent and meaning are clear, shall be permitted to be used in headings and in the body of the table.

**3.7.2.6 Units of Measure.**

**3.7.2.6.1** Units of measure shall always be given in the title, column headings, or table footnote as needed.

**3.7.2.6.2** When the same unit of measure is used throughout a column, the unit of measure shall be given in the column heading instead of the column itself.

**3.7.2.6.3** When a column contains more than one unit of measure, then the units of measure shall be used in the column and not in the column heading.

**3.7.2.6.4** Units of measure shall be abbreviated in tables.

**3.7.2.7 Vacant Cells.** An em dash (—) shall be used to indicate a vacant cell.

**3.7.2.8 Numerical Columns.**

**3.7.2.8.1** Tabular material shall be centered in each column for columns with inclusive numbers and entries in mixed word/number columns.

**3.7.2.8.2** All numbers shall be aligned on the decimal point, and zeroes shall be placed before the decimal point in numbers less than one.

**3.7.2.8.3** Decimal indications shall be used in tabular work unless fractions are commonly used in the field.

**3.7.2.9 Reading Columns.**

**3.7.2.9.1** Reading columns (i.e., columns in which only words appear) shall be aligned on the left.

**3.7.2.9.2** Runover lines shall be indented under the line to which they apply.

**3.7.2.9.3** All entries of a reading column shall be grammatically parallel.

**3.7.2.9.4** A concluding period shall not be used unless the entry is one or more complete sentences.

**3.7.2.10 Breaking.**

**3.7.2.10.1** Tables shall fit vertically on a page.

**3.7.2.10.2\*** When a table carries over for more than one page, the heading shall read “Continued” on successive pages.

**3.7.2.11 General Table Notes and Table Footnotes.**

**3.7.2.11.1** Notes shall only be permitted as table notes.

**3.7.2.11.2** All table notes shall appear directly beneath the table and not at the foot of the page.

**3.7.2.11.3** General table note(s) shall be indicated using the word “Note(s)” followed by consecutively numbered text notes.

**3.7.2.11.4** General table notes shall precede keyed table footnotes.

**3.7.2.11.5** Keyed table footnotes shall be identified as follows:

- (1) If there is one footnote, an asterisk shall be used.
- (2) If there are two footnotes, an asterisk and a dagger shall be used.



- (3) If there are three or more footnotes, superscript letters shall be used.

### 3.7.3\* Formulas and Equations.

3.7.3.1 Punctuation shall be inserted following equations as grammatically necessary for sentence flow.

3.7.3.2 Explanation of terms shall appear under the formula or equation introduced by the word *where*.

3.7.3.3 The explanatory material shall be permitted to be omitted if symbols and letters are explained in a table of symbols elsewhere in the document.

3.7.3.4 Fractions shall be single case (e.g.,  $\frac{7}{8}$  rather than 7/8).

### 3.7.4 Letter Symbols and Variables.

3.7.4.1\* Where applicable and possible, the appropriate symbols from ANSI Y10, *American National Standards Institute Series on Letter Symbols*, shall be used.

3.7.4.2 Letter symbols and variables shall be printed in italics. When subscript or superscript, a letter symbol or variable shall be italicized.

3.7.4.3\* The intent of the subscripts shall be made clear in a "where" list.

3.7.4.4 Sub- and superscripts consisting of numbers or mathematical functions shall be roman.

### 3.7.4.5 Temperature.

3.7.4.5.1 To express temperature on the temperature scales C, F, and R, the degree symbol shall be used with the appropriate letter symbol (e.g., 69°C is the acceptable abbreviation for 69 degrees Celsius).

3.7.4.5.2 The degree symbol shall not be required for absolute temperature scale of kelvin (K).

3.7.4.6 To express angle dimensions, the degree symbol preceded by a number shall be permitted to be used.

## 3.8 Annexes.

### 3.8.1 General.

3.8.1.1 Annexes shall be identified by means of consecutive letters (e.g., the first annex in a document shall be Annex A; the second, Annex B).

3.8.1.2 All annexes shall be titled.

3.8.2 Annex A. See also 1.9.1.7.

3.8.2.1 The first (or only) annex shall be used for explanatory or informative material on the text of the document, and it shall carry the title Annex A Explanatory Material.

3.8.2.2 Each subdivision within this annex shall carry the same number as the subdivision in the document to which it applies, preceded by the letter A and a period (e.g., A.1.2, A.1.2.1).

3.8.2.3 An asterisk shall be inserted after the subdivision number in the text of the body of the document to indicate that explanatory material on that subdivision can be found in the annex.

### 3.8.3 Additional Annexes.

3.8.3.1 All subdivisions within an annex shall be numbered in the form used for the chapters within the main text of the document.

3.8.3.2\* The annex letter followed by a period shall be used as the prefix for all subdivision numbers within the annex.

3.8.3.3 Figures and tables shall also be identified by the annex letter and section number (e.g., Figure B.1.2.2 is found in Annex B).

3.8.4 Last Annex. Where nonmandatory references are used, they shall be listed in the last annex, which shall be titled Informational References. (See 1.9.10.)

3.9 Vertical Rules and Bullets. See also 1.5.2.5.2(6).

3.9.1\* In partial revisions of documents, vertical rules and bullets shall be used in the left margin to indicate committee-approved revisions to text, figures, and tables.

3.9.2 Vertical rules (|) shall indicate where a change, addition, or partial deletion has occurred to a line of text.

3.9.3 Bullets (•) shall indicate where one or more complete paragraphs have been deleted.

3.9.4 Bullets shall appear between the current existing paragraphs to indicate the deletion.

## Chapter 4 Units of Measurement

### 4.1 Measurement Systems.

4.1.1 System Preference. The system of measurement used in all NFPA codes, standards, recommended practices, and guides (hereinafter called documents) shall conform to one of the three following conventions:

- (1) Measurements shall be presented in International Units, commonly known as SI or metric units and referred to herein as SI units, alone.
- (2) Measurements shall be presented in SI units followed in parentheses by the equivalent value presented in inch-pound units.
- (3) Measurements shall be presented in inch-pound units followed in parentheses by the equivalent value presented in SI units.

4.1.2 Consistent Usage. The convention selected from 4.1.1(1), 4.1.1(2), or 4.1.1(3) shall be used consistently throughout the document except as permitted in 4.1.3 and 4.1.4.2.

4.1.3\* Industry Practice. Where one measurement system is internationally accepted for unique measurements, no additional units or conversions shall be required.

4.1.4 Extracted Material. Extracted material containing units of measurement shall comply with 4.1.4.1 or 4.1.4.2 as appropriate.

4.1.4.1 Where the extracted material contains values expressed in both systems of measurement, the units shall be arranged in position to provide consistent usage in accordance with 4.1.2.

4.1.4.2 Where the extracted material contains values expressed only in one system of measurement, the following shall apply.

- (1) The extracted values shall be retained without modification, and no conversion shall be provided.
- (2) A statement shall be included in the “Units of Measurement” section of Chapter 1 as follows: “Where extracted text contains values expressed in only one system of units, the values in the extracted text have been retained without conversion to preserve the values established by the responsible technical committee in the source document.” (See Section 4.4 and A.4.4.)

**4.2 Accuracy and Precision.** The value expressed for a measurement shall reflect the accuracy and precision intended for the measurement.

**4.2.1\* Basis of Measurement.** The intended accuracy and precision shall be established from a clear understanding of its basis.

**4.2.1.1\* The precision used to express a measurement shall not exaggerate the accuracy intended for the measurement.**

**4.2.1.2\* The precision used to express a measurement shall not degrade the accuracy intended for the measurement.**

**4.2.2\* Enforcement.** The value expressed for a measurement shall reflect what is intended and practical for application and enforcement.

**4.2.3 Tolerances.** The use of tolerances shall be permitted for expressing the intended precision of a measurement value as needed.

**4.2.4 Trade Sizes.** Where the actual measured size of a product is not the same as the nominal size, trade size designators shall be used rather than dimensions unless otherwise permitted by 4.3.5.2.

**4.3\* Conversion.** (See Annex B, *SI Units and Conversions*, for additional information on SI units and conversions.)

**4.3.1\* Equivalent Values.** Where both systems of measurement are used in the document, the values shall be equivalent within the precision intended for the measurement.

**4.3.2\* Calculation.** Conversion calculations shall use unrounded or appropriately precise values of the conversion factor and measurement value throughout the calculation to produce the converted value for subsequent appropriate rounding.

**4.3.3 Rounding.**

**4.3.3.1** The base value being converted and the converted value shall be rounded to comply with 4.2.1.

**4.3.3.2** The converted value shall be rounded such that the last place digit of the converted value is equal to or less than the converted value of the intended precision. (See *conversion steps outlined in B.8.3.*)

**4.3.4\* Tolerances.** Where tolerances are used and the measurement value is expressed in both systems of measurement, special attention shall be given to maintaining intended equivalence between the two values when converting units.

**4.3.5\* Trade Size Conversion.**

**4.3.5.1** Where trade sizes are specified that involve the use of nominal dimensions to designate material, products, or performance, an appropriate counterpart trade size in the measurement system of conversion shall be used or included that satisfies the technical needs of the requirement or recommendation.

**4.3.5.2** Where trade sizes are specified that involve the use of precisely designated critical dimensions, conversion shall comply with one of the following:

- (1) An appropriate counterpart trade size in the measurement system of conversion shall be used or included that satisfies the technical needs of the requirement or recommendation.
- (2) An equivalent value shall be included that is based on an exact conversion of the critical dimension with rounding to an appropriate precision. An appropriate disclaimer indicating that the converted value is provided for dimensional reference only and does not reflect an actual trade size in the measurement system of conversion shall be included.

**4.4\* Units of Measure.** A statement shall be included in Chapter 1 establishing the units of measure. (See 1.6.1.7.)

**4.5 Reference Publication.** As a supplement to the criteria contained within Chapter 4 and for items not addressed herein, the reference document on which all SI conversions are to be based shall be IEEE/ASTM SI 10, *Standard for Use of the International System of Units (SI): the Modern Metric System*, 1997.

## Annex A Explanatory Material

**A.1.5.2.2.2.3** The origin and development statement provides the user of the document with a quick overview of the history of the document and the development of the technical requirements within the document, including the major changes from the latest revision.

**A.1.5.2.3.7** The technical committee scope should not be confused with the scope of the document (see A.1.6.1.2). The technical committee scope is provided by the Standards Council to outline the area(s) in which the technical committee can develop a technical document(s).

**A.1.5.2.5.2(6)** Vertical rules and marginal bullets aid the user in identifying where changes have been made to the document during the latest revision.

**A.1.5.2.5.2(7)** The reference in brackets following extracted text (e.g., [101:7.3.4.5]) indicates the source document (i.e., NFPA 101) and the source paragraph (i.e., 7.3.4.5).

**A.1.6.1.2** The scope of the document should not be confused with the scope of the technical committee (see A.1.5.1.3.7). The scope of the document is developed by the technical committee to establish what the document is intended to cover. The following is an example of a scope:

**1.1 Scope.** This standard shall provide the minimum requirements for the design and installation of automatic fire sprinkler systems and exposure protection sprinkler systems covered within this standard.

**A.1.6.1.3** The following is an example of a purpose:

**1.2\* Purpose.**

**1.2.1** The purpose of this standard shall be to provide a reasonable degree of protection for life and property from fire through standardization of design, installation, and testing requirements for sprinkler systems including private fire service mains, based on sound engineering principles, test data, and field experience.

**1.2.2** Sprinkler systems and private fire service mains are specialized fire protection systems and shall require knowledgeable and experienced design and installation.

**A.1.6.1.4** The following is an example of an application:

**1.3\* Application.**

**1.3.1** This standard shall apply to the following.

- (1) Character and adequacy of water supplies
- (2) Selection of sprinklers
- (3) Fittings
- (4) Piping
- (5) Valves
- (6) All materials and accessories, including the installation of private fire service mains

**1.3.2** This standard shall also apply to “combined service mains” used to carry water for both fire service and other uses as well as mains for fire service use only.

**A.1.6.1.5** The following is suggested as wording that might be included in a code or standard to cover the subject of retroactivity if it is determined by the committee that a retroactivity statement is needed. The insertion of (*document type*) refers to the type of document that the technical committee is developing (i.e., code, standard, recommended practice, or guide).

**1.X Retroactivity.** The provisions of this (*document type*) reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this (*document type*) at the time the (*document type*) was issued.

**1.X.1** Unless otherwise specified, the provisions of this (*document type*) [*shall, should*] not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the (*document type*). Where specified, the provisions of this (*document type*) [*shall, should*] be retroactive.

**1.X.2** In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction [*shall, should*] be permitted to apply retroactively any portions of this (*document type*) deemed appropriate.

**1.X.3** The retroactive requirements of this (*document type*) [*shall, should*] be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

**A.1.6.1.6** The following is suggested uniform wording on equivalency for use by those NFPA committees desiring an equivalency statement. The insertion of (*document type*) refers to the type of document that the technical committee is developing (i.e., code, standard, recommended practice, or guide).

**1.X Equivalency.** Nothing in this (*document type*) is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this (*document type*).

**1.X.1** Technical documentation [*shall, should*] be submitted to the authority having jurisdiction to demonstrate equivalency.

**1.X.2** The system, method, or device [*shall, should*] be approved for the intended purpose by the authority having jurisdiction.

**A.1.6.1.8.1** The following sample ordinance or one acceptable to the technical committee should be placed in a separate annex to meet the requirements of 1.6.1.8.1.

**X.1** The following sample ordinance is provided to assist a jurisdiction in the adoption of this [*code, standard*] and is not part of this [*code, standard*].

ORDINANCE NO. \_\_\_\_\_

An ordinance of the [*jurisdiction*] adopting the [*year*] edition of NFPA [*document number*], [*complete document title*], and documents listed in Chapter 2 of that code; prescribing regulations governing conditions hazardous to life and property from fire or explosion; providing for the issuance of permits and collection of fees; repealing Ordinance No. \_\_\_\_\_ of the [*jurisdiction*] and all other ordinances and parts of ordinances in conflict therewith; providing a penalty; providing a severability clause; and providing for publication; and providing an effective date.

BE IT ORDAINED BY THE [*governing body*] OF THE [*jurisdiction*]:

**SECTION 1** That the [*complete document title*] and documents adopted by Chapter 2, three (3) copies of which are on file and are open to inspection by the public in the office of the [*jurisdiction's keeper of records*] of the [*jurisdiction*], are hereby adopted and incorporated into this ordinance as fully as if set out at length herein, and from the date on which this ordinance shall take effect, the provisions thereof shall be controlling within the limits of the [*jurisdiction*]. The same are hereby adopted as the code of the [*jurisdiction*] for the purpose of prescribing regulations governing conditions hazardous to life and property from fire or explosion and providing for issuance of permits and collection of fees.

**SECTION 2** Any person who shall violate any provision of this code or standard hereby adopted or fail to comply therewith; or who shall violate or fail to comply with any order made thereunder; or who shall build in violation of any detailed statement of specifications or plans submitted and approved thereunder; or failed to operate in accordance with any certificate or permit issued thereunder; and from which no appeal has been taken; or who shall fail to comply with such an order as affirmed or modified by or by a court of competent jurisdiction, within the time fixed herein, shall severally for each and every such violation and noncompliance, respectively, be guilty of a misdemeanor, punishable by a fine of not less than \$ \_\_\_\_\_ nor more than \$ \_\_\_\_\_ or by imprisonment for not less than \_\_\_\_\_ days nor more than \_\_\_\_\_ days or by both such fine and imprisonment. The imposition of one penalty for any violation shall not excuse the violation or permit it to continue; and all such persons shall be required to correct or remedy such violations or defects within a reasonable time; and when not otherwise specified the application of the above penalty shall not be held to prevent the enforced removal of prohibited conditions. Each day that prohibited conditions are maintained shall constitute a separate offense.

**SECTION 3** Additions, insertions, and changes — that the [*year*] edition of NFPA [*document number*], [*complete document title*] is amended and changed in the following respects:

List Amendments

**SECTION 4** That ordinance No. \_\_\_\_\_ of [*jurisdiction*] entitled [*fill in the title of the ordinance or ordinances in effect at the present time*] and all other ordinances or parts of ordinances in conflict herewith are hereby repealed.

**SECTION 5** That if any section, subsection, sentence, clause, or phrase of this ordinance is, for any reason, held to be invalid or unconstitutional, such decision shall not affect the validity or constitutionality of the remaining portions of this ordinance. The [*governing body*] hereby declares that it would have passed this ordinance, and each section, subsection, clause, or phrase hereof, irrespective of the fact that any

one or more sections, subsections, sentences, clauses, and phrases be declared unconstitutional.

**SECTION 6** That the [*jurisdiction's keeper of records*] is hereby ordered and directed to cause this ordinance to be published. [NOTE: An additional provision may be required to direct the number of times the ordinance is to be published and to specify that it is to be in a newspaper in general circulation. Posting may also be required.]

**SECTION 7** That this ordinance and the rules, regulations, provisions, requirements, orders, and matters established and adopted hereby shall take effect and be in full force and effect [*time period*] from and after the date of its final passage and adoption.

**A.1.6.1.9** Examples of additional administrative sections include safety, formulas, variables, and symbols.

**A.1.6.3.5.2** The following is an example of the format for definitions used in a chapter:

**5.1 Special Definitions.**

**5.1.1 Building.** Any structure used . . . (*See 33.17.1.*)

**5.1.2 Fire Lane.** The road or other means . . . (*See 33.136.1.*)

**A.1.6.3.5.3** The following is an example of the format for a list of defined terms used in a chapter:

**5.1 Special Definitions.** A list of special terms used in this chapter follows:

- (1) Alternative Calculation Procedure. See 3.3.7.
- (2) Data Conversion. See 3.3.38.
- (3) Design Fire Scenario. See 3.3.41.

**A.1.7.1** When administrative sections are used in more than one chapter, it is preferable that they be used consistently throughout the document. For example, if Sections 4.1 and 5.1 are Scope, then all other chapters should start out with a Section X.1 Scope.

**A.1.7.2** If two or more of the administrative sections listed in 1.7.1 are used, Section X.1 should be titled Administration and the administrative sections would become subsections, as in the following example:

**4.1 Administration.**

**4.1.1 Scope.** This chapter provides criteria . . .

**4.1.2 Special Definitions.**

**4.1.2.1 Building.** Any structure used . . .

**4.1.2.2 Fire Lane.** The road or other means . . .

**A.1.8.3.3** An example of a permitted use of inconsistent titles in subsections is as follows:

**4.8.1** Fixed, unburied flammable or combustible liquid storage tanks shall be provided with containment or drainage in accordance with NFPA 30, *Flammable and Combustible Liquids Code*.

**4.8.2** Flammable or combustible liquids shall not be stored or processed underneath cable trays or inside cable-spreading rooms or tunnels.

**4.8.3 Ignition.**

**4.8.3.1** Precautions shall be taken to prevent the ignition of flammable and combustible liquid vapors.

**4.8.3.2** Possible sources of ignition shall include but are not limited to the following:

- (1) Open flames
- (2) Smoking
- (3) Cutting and welding

**A.1.9.1** Annexes are provided for clarification, illustration, and general information.

**A.1.11** The development process information sheets include the following:

- (1) Codes and standards development process outline
- (2) Guide to committee member classifications
- (3) Example of completed proposal form
- (4) Blank proposal form

**A.2.1** *Technical style* is how the technical requirements are presented to the user. Chapter 2 addresses how the technical committee should write the technical requirements of the document. Technical style is separate from editorial style, in which the technical wording is modified to ensure that the presentation is grammatically accurate and understandable.

**A.2.2.2** The technical committee should review all wording within its code(s) or standard(s) to ensure that the requirements and its respective wording is not vague or unenforceable. When terms are vague or unenforceable, the requirements can often be misapplied or misinterpreted.

**A.2.2.2.1** Examples of unenforceable language are as follows:

- (1) Portable fire extinguishers shall be located to consider the occupants' *safety*.
- (2) A manual pull station shall be located *near* each exit.

Examples of enforceable language are as follows:

- (1) All flammable liquids shall be stored in listed *safety* cans.
- (2) A manual pull station shall be located *within 1 m* of each exit.

**A.2.2.2.3** The terms contained in Table 2.2.2.3 are not prohibited from use within NFPA documents. However, these terms, if used incorrectly, can be unenforceable or vague. Table 2.2.2.3 is provided to highlight terms that the technical committee should review to ensure that in context they are not unenforceable or vague. Terms listed in Table 2.2.2.3 are appropriate if used in the proper context.

**A.2.2.3.1** Technical committees should retain only those judgmental items that clearly depend on local field conditions or where complete information on hazards, protection methods, or safety measures is not available to specify actual requirements.

**A.2.2.3.2** An example of multiple levels of safety (not permitted) is as follows:

Fire protection in a single-family residence shall be based on one of the following levels of protection:

Option 1. A single station smoke detector shall be installed outside each sleeping area.

Option 2. A single station smoke detector shall be installed on every level of the home.

Option 3. A single station smoke detector shall be installed on every level of the home and in each sleeping room.

Each option provides a different level of safety for a single application. The use of differing requirements for new and existing situations or *trade-offs* for other protection arrangements should not be considered multiple levels of safety.

**A.2.2.3.3** Examples of multiple design levels include differing loads such as snow, wind, and seismic depending on geographic location.

**A.2.2.6** Some standards are product standards as opposed to performance, use, or installation standards. One example of a product standard is NFPA 1150, *Standard on Fire-Fighting Foam Chemicals for Class A Fuels in Rural, Suburban, and Vegetated Areas*. The scope of NFPA 1150 reads: "This standard specifies

requirements and test procedures for foam chemicals used on Class A fuels.” NFPA 1150 only contains requirements on Class A foam characteristics and test procedures. The use of Class A foams is not covered in this standard.

**A.2.2.6.1** Because product standards should be written, to the extent possible, as performance requirements with specific pass/fail requirements and a designated test method to evaluate the performance, an equivalency statement (*see 1.6.1.6*) should be included in the standard.

**A.2.2.6.2** Product standards are considered to contain performance, testing, and third-party certification requirements for products. They can contain design requirements as well.

Third-party certification includes the requirements for the testing, labeling, listing, follow-up, and quality assurance programs by which a product is certified as being compliant with a specific standard from a certification organization.

“User requirements” are those that apply to users of the product and specify when/where/how a product is used. Where product standards need to make reference to where user requirements can be found, or provide helpful general information for user consideration or user understanding of the standard’s requirements, such material should be placed in the annex of the product standard.

**A.2.2.7.1** Examples would include chemical exposure, radiological exposures, and various environmental or health considerations.

**A.2.2.7.2** The NFPA Board of Directors approves TACs when necessary. For a current list of NFPA TACs contact the NFPA Standards Council.

**A.2.3.1.2** The insertion of (*document type*) refers to the type of document that the technical committee is developing (i.e., code or standard).

**A.2.3.1.3** The insertion of (*document type*) refers to the type of document that the technical committee is developing (i.e., code or standard).

**A.2.3.2.4** Examples of inappropriate references in definitions are as follows:

(1) **Air Connector.** A conduit for transferring air between an air duct or plenum and an air terminal unit or an air inlet or an air outlet. (*For limitations on use of air connectors, see 5.3.2.1.*)

(2) **Fusion Temperature Ash.** The temperature at which a cone of coal or coke ash exhibits certain melting characteristics. (*See ASTM D1857, Standard Test Method for Fusibility of Coal and Coke Ash.*)

**A.2.3.2.6** Existing boilerplate definitions from the *Regulations Governing Committee Projects* are as follows:

**Approved** — Acceptable to the authority having jurisdiction.

The annex material for “Approved” reads as follows:

The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is

thus in a position to determine compliance with appropriate standards for the current production of listed items.

**Authority Having Jurisdiction (AHJ)** — An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

The annex material for “Authority Having Jurisdiction” reads as follows:

The phrase “authority having jurisdiction,” or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

**Code** — A standard that is an extensive compilation of provisions covering broad subject matter or that is suitable for adoption into law independently of other codes and standards.

The annex material for “Code” reads as follows:

The decision to designate a standard as a “code” is based on such factors as the size and scope of the document, its intended use and form of adoption, and whether it contains substantial enforcement and administrative provisions.

**Consensus** — Consensus has been achieved when, in the judgement of the Standards Council of the National Fire Protection Association, substantial agreement has been reached by materially affected interest categories. Substantial agreement means much more than a simple majority but not necessarily unanimity. Consensus requires that all views and objections be considered and that a concerted effort be made toward their resolution. The Standards Council bases its judgement as to when a consensus has been achieved on the entire record before the Council.

**Guide** — A document that is advisory or informative in nature and that contains only nonmandatory provisions. A guide may contain mandatory statements such as when a guide can be used but the document as a whole is not suitable for adoption into law.

**Labeled** — Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Listed** — Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that

either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

The annex material for “Listed” reads as follows:

The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

**Recommended Practice** — A document that is similar in content and structure to a code or standard but that contains only nonmandatory provisions using the word “should” to indicate recommendations in the body of the text.

**Shall** — Indicates a mandatory requirement.

**Should** — Indicates a recommendation or that which is advised but not required.

**Standard** — A document, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

**A.2.3.2.7** Prior to revising preferred definitions, the *Glossary of Terms* should be consulted to avoid the creation of additional secondary definitions. All secondary definitions should be reviewed and eliminated where possible by the following methods (in order of preference):

- (1) Adopt the preferred definition if suitable.
- (2) Modify the secondary term and definition to make it unique.
- (3) Request that the Standards Council determine responsibility for the term.
- (4) Request that the Standards Council authorize a secondary definition.

**A.2.3.2.10** When adopting definitions with annex material, only the definition should be adopted unless the adopting committee wishes specifically to include the annex material. Many definitions presently contain references to the main text of the document. It is anticipated that these references will be moved to the annex of the document. This information should not constitute an additional definition in the *Glossary of Terms*.

**A.2.3.2.12.1** An example of an appropriate extract reference is as follows:

**3.3.9 Addition.** An increase in building area, aggregate floor area, height, or number of stories of a structure.  
[ASCE 7:9.2.1.1]

**A.2.3.3.3** The following is an example of a mandatory reference to a figure:

Specimen mounting shall be as shown in Figure 5.2.1.

The following is an example of a nonmandatory reference to a figure:

Figure 5.2.1 shows a typical specimen-mounting set-up.

**A.2.3.5.2** Exceptions can often be avoided by rewording the main rule. An example of a rule and exception that have been rewritten to eliminate the exception is as follows:

**Rule: 6.2.4.2.4** Where joist channels are wider than 0.6 m (2 ft), more than one discharge device shall be required per channel.

*Exception: If a single discharge device being used is listed for the width of the joist channel being protected.*

*Rewritten to eliminate the exception: 6.2.4.2.4* Unless the single discharge device being used is listed for the width of the joist channel, more than one discharge device shall be required per joist channel if joist channels are wider than 0.6 m (2 ft).

**A.2.3.5.5** An example of an improper list of exceptions indicating that the basic rule is inapplicable is as follows:

**4.13.1.1** All concealed spaces enclosed wholly or partly by exposed combustible construction shall be protected by sprinklers.

*Exception No. 1: Concealed spaces formed by studs or joists with less than 152 mm (6 in.) between the inside or near edges of the studs or joists. (See Figure 4.6.4.1.4.)*

*Exception No. 2: Concealed spaces formed by ceilings attached directly to or within 152 mm (6 in.) of wood joist construction.*

*Exception No. 3: Concealed spaces formed by ceilings attached directly to the underside of composite wood joist construction, provided the joist channels are firestopped into volumes each not exceeding 4.53 m<sup>3</sup> (170 ft<sup>3</sup>) using materials equivalent to the web construction.*

*Exception No. 4: Concealed spaces entirely filled with noncombustible insulation.*

*Exception No. 5: Concealed spaces within wood joist construction and composite wood joist construction having noncombustible insulation filling the space from the ceiling up to the bottom edge of the joist of the roof or floor deck, provided that in composite wood joist construction the joist channels are firestopped into volumes each not exceeding 4.53 m<sup>3</sup> (160 ft<sup>3</sup>). The joists shall be firestopped to the full depth of the joist with material equivalent to the web construction.*

*Exception No. 6: Concealed spaces over isolated small rooms not exceeding 4.6 m<sup>2</sup> (55 ft<sup>2</sup>) in area.*

*Exception No. 7: Where rigid materials are used and the exposed surfaces have a flame spread rating of 25 or less and the materials have been demonstrated not to propagate fire in the form in which they are installed in the space.*

*Exception No. 8: Concealed spaces in which the exposed materials are constructed entirely of fire-retardant treated wood as defined by NFPA 703, Standard for Fire Retardant Impregnated Wood and Fire Retardant Coatings for Building Materials.*

*Exception No. 9: Noncombustible concealed spaces having exposed combustible insulation where the heat content of the facing and substrate of the insulation material does not exceed 11,356 kJ/m<sup>2</sup> (1000 Btu per ft<sup>2</sup>).*

**A.2.3.8** An example of a cautionary statement is as follows:

**CAUTION:** It is undesirable to attempt to extinguish this type of fire unless there is reasonable assurance that the source of fuel can be promptly shut off.

**A.2.3.9.1** An example of a mandatory cross-reference is as follows:

**12.4.1.2.1** Ventilation of anesthetizing locations shall conform to 5.4.1.

**A.2.3.9.2** An example of a nonmandatory cross-reference is as follows:

**16.3.4.1** A single alarm panel, as described in 4.3.1.2.1, shall be mounted in an area of continuous surveillance while the facility is in operation.

**A.2.3.10.1** Examples of references to other documents within the mandatory text are as follows:

**10.6.3** Where sprinklers are required, they shall be installed in accordance with the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*.

**10.6.4** Pumps used to meet the water supply requirements of 4.5.6 shall be installed in accordance with the requirements of NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*.

**A.2.5.1.1** An example of a requirement revised to be denationalized is as follows:

**Original (national):**

**7.3.4 Special Equipment for Emergency Personnel.** Self-contained breathing apparatus (SCBA) using full-face, positive-pressure masks approved by the National Institute for Occupational Safety and Health (NIOSH) shall be provided for fire brigade and control room personnel.

**Revised (denationalized):**

**7.3.4 Special Equipment for Emergency Personnel.** Self-contained breathing apparatus (SCBA) using full-face, positive-pressure masks shall meet or exceed the requirements of 42 CFR 84, “Respiratory Protective Devices, Tests for Permissibility,” and shall be provided for fire brigade and control room personnel.

**A.2.5.1.2** Some examples of international referenced documents are ASME, ASTM, BSI, CSA, IEC, ISO, and NFPA.

**A.2.6** Extracting provides an advantage to using multiple references to requirements contained within other NFPA documents. Extracting has the disadvantage of creating a situation where the text of the source document and the user document are not identical due to the timing of each document’s revision cycle.

**A.2.6.1.1** The following is an example of the proper reference used for an extract:

**8.4.1** The branch-circuit conductors supplying one or more units of a data processing system shall have an ampacity not less than 125 percent of the total connected load. [70:645.5]

In the rare cases where an extract is being taken from an old (non-current) edition of an NFPA document, the citation will need to include the year as well, e.g., [58, 1998:4-2].

**A.2.6.2.3** Exception and caution statements are part of the requirements of the associated paragraph.

**A.2.6.3.1** If a paragraph with two subparagraphs is renumbered as three separate and distinct paragraphs, does that change the relationship of paragraph two and three to the original paragraph one? Many times subparagraphs refine requirements in the host paragraph and renumbering changes that emphasis and possibly compromises that relationship.

*Incorrect renumbering:*

| <b>Parent Document</b> | <b>Document Extracting</b> |
|------------------------|----------------------------|
| 7.5.1.1 Paragraph      | 8.2.3.1 Paragraph          |
| 7.5.1.1.1 Subparagraph | 8.2.3.2 Paragraph          |
| 7.5.1.1.2 Subparagraph | 8.2.3.3 Paragraph          |
| 7.5.1.2 Paragraph      | 8.2.3.4 Paragraph          |

*Correct renumbering:*

| <b>Parent Document</b> | <b>Document Extracting</b> |
|------------------------|----------------------------|
| 7.5.1.1 Paragraph      | 8.2.3 Paragraph            |
| 7.5.1.1.1 Subparagraph | 8.2.3.1 Subparagraph       |
| 7.5.1.1.2 Subparagraph | 8.2.3.2 Subparagraph       |
| 7.5.1.2 Paragraph      | 8.2.4 Paragraph            |

**A.3.1** Editorial style addresses how the technical requirements appear in the final text format.

**A.3.2.2.1** An example of simpler spelling is as follows:

catalog instead of catalogue

The following is a list of preferred spelling and punctuation for troublesome “fire” words that frequently appear in NFPA documents.

*Rule of Thumb:* Except for noun-noun compounds, such as firehouse, that are treated as one word per Webster’s Dictionary, noun-noun compounds are treated as two words (no hyphenation) as nouns and as adjectives before another noun per the examples given here.

**Noun-Noun Compounds: Always Two Words (noun and adjective forms)**

- fire alarm, fire alarm system
- fire apparatus, fire apparatus driver
- fire area, fire area management
- fire attack, fire attack method
- fire barrier, fire barrier assembly
- fire command, fire command center
- fire control, fire control plans
- fire curtain
- fire damage, fire damage control
- fire damper
- fire department, fire department vehicle
- fire detection, fire detection device
- fire detector, fire detector device
- fire door, fire door assembly
- fire drill, fire drill procedures
- fire escape, fire escape route
- fire endurance, fire endurance rating, fire endurance test, fire endurance classification
- fire exposure, fire exposure conditions, fire exposure test
- fire extinguisher
- fire fighter, fire fighter injuries
- fire flow, fire flow test
- fire growth, fire growth potential
- fire hazard, fire hazard properties
- fire hose, fire hose nozzles
- fire incident, fire incident report
- fire load
- fire loss, fire loss prevention
- fire point
- fire prevention, fire prevention system
- fire protection, fire protection plan
- fire resistance rating, 1-hour fire resistance rating
- fire training, fire training center
- fire responder, fire responder task
- fire risk, fire risk assessment
- fire safety, fire safety education
- fire service, fire service personnel
- fire screen
- fire spread, fire spread rating
- fire storm, fire storm area
- fire suppression, fire suppression system
- fire stream, fire stream spray
- fire tower, fire tower training
- fire wall, fire wall assemblies
- fire water
- fire zone

**Noun-Noun Compounds: Always One Word (noun and adjective forms)**

- fireboat

firebomb  
 firebox  
 firebreak  
 firebrick  
 firecracker  
 fireground, fireground management  
 fireguard  
 firehouse  
 fireplace  
 fireplug  
 fireproof, fireproofing  
 firestop, firestopped, firestopping  
 firetrap  
 fireworks

**Hyphenated Compounds (adjective form before the noun)**

fire-activated system  
 fire-blocking cushions  
 fire-caused failure  
 fire-damaged equipment  
 fire-detecting device  
 fire-extinguishing equipment  
 fire-fighting equipment,  
 fire-fighting foam chemicals  
 fire-fighting operations  
 fire-preventive steps  
 fire-protective systems  
 fire-rated equipment  
 fire-reporting systems  
 fire-resistant material  
 fire-resistive coating, fire-resistive-rated elements  
 fire-retardant resins, fire-retardant-treated wood,  
 fire-retardant-impregnated wood  
 fire-safe building  
 fire-signaling equipment  
 fire-suppressing device  
 fire-warning equipment

**Miscellaneous Hyphenated Compounds**

fire-gas (n)  
 fire-protect (v) (to fire-protect steel)  
 fire-fight (v)

**A.3.2.3.2** Examples of capitalization for titles are as follows:

Section 4.1  
 Figure 4.2.3  
 Annex A

**A.3.2.3.3** Examples of specific terms requiring capitalization are as follows:

Type M cable  
 Level A responder

**A.3.2.3.6.2** Examples of labels associated with units of measure are as follows:

50-mm stainless steel rod  
 250 g of product

**A.3.2.4.1.3.3** General definitions taken from another document should be treated as extracts with the reference to the parent document given in brackets at the end of the extracted definition (see 2.3.2.10).

**A.3.2.4.2.3** The following is an example of a main entry, a sub-entry, and a sub-subentry:

**3.3.20 Enclosure.**

**3.3.20.1 Continuous Enclosure.** A recognized architectural or mechanical component of a building having a fire resistance rating as required for the structure and whose

purpose is to enclose the vapor removal duct for its full length to its termination point outside the structure without any portion of the enclosure having a fire resistance rating less than the required value.

**3.3.20.2 Grease Duct Enclosure.** An enclosure system evaluated for reduced clearances to combustibles and as an alternative to a duct with its fire-rated enclosure.

**3.3.20.2.1 Factory-Built Grease Duct Enclosure.** A listed factory-built grease duct system evaluated as an enclosure system for reduced clearances to combustibles and as an alternative to a duct with its fire-rated enclosure.

**3.3.20.2.2 Field-Applied Grease Duct Enclosure.** A listed system evaluated for reduced clearances to combustibles and as an alternative to a duct with its fire-rated enclosure.

**A.3.2.4.3.2** The following is an example of an umbrella head without a definition:

**3.3.21 Turret.**

**3.3.21.1 Extendable Turret.** A device, permanently mounted with a power-operated boom or booms, designed to supply a large-capacity, mobile, elevated water stream or other fire-extinguishing agents, or both.

**3.3.21.2 Primary Turret.** The largest capacity foam turret used to apply primary extinguishing agent.

The following is an example of an umbrella head with a definition:

**3.3.19 Seam.** Any permanent attachment of two or more protective garment fabrics in a line formed by joining the separate material pieces.

**3.3.19.1 Major Seam.** A seam assembly construction where rupture exposes the wearer to immediate danger.

**3.3.19.2 Sewn Seam.** A series of stitches joining two or more separate plies of material(s) of planar structure, such as textiles.

**A.3.2.4.4.2** See A.3.2.4.2.3.

**A.3.2.4.5.3** See A.3.2.4.2.3.

**A.3.3.1.1.1** The following is an example of a correctly worded numbered list:

The following equipment shall be kept in good working condition:

- (1) Cooking equipment
- (2) Hoods
- (3) Ducts (if applicable)
- (4) Fans
- (5) Fire-extinguishing equipment
- (6) Special effluent or energy control equipment

The following is an example of an incorrectly worded numbered list:

The wiring shall be tested for:

- (1) Physical integrity
- (2) Polarity
- (3) Continuity of grounding at the time of assembly

**A.3.3.1.1.2** Sentences with lists in the middle are ambiguous and open to misinterpretation.

**A.3.3.1.2.3** The following sentence-style list contains mandatory language in the intro sentence, but not in the individual items.

**7.4.8** If a cigarette extinguishes before burning its entire length, another cigarette shall be placed on a fresh area of the cover fabric until one of the following occurs:

- (1) Three cigarettes have burned their entire length.
- (2) Three cigarettes have self-extinguished.



**A.3.3.1.3.2** An example of a sublist is as follows:

**9.5.8** The protection area of coverage per sprinkler ( $A_s$ ) shall be determined as follows:

- (1) Along the wall as follows:
  - (a) Determine the distance between sprinklers along the wall (or to the end wall or obstruction in the case of the end sprinkler on the branch line) upstream and downstream.
  - (b) Choose the larger of either twice the distance to the wall or distance to the next sprinkler.
  - (c) The dimension will be defined as  $S$ .
- (2) Across the room as follows:
  - (a) Determine the distance from the sprinkler to the wall opposite the sprinklers or to the mid-point of the room where sprinklers are installed on two opposite walls.
  - (b) This dimension will be defined as  $L$ .

**A.3.3.4.2** The following is an example of a numbered equation:

$$t_f = \left( 10^{-4} \frac{\text{sec}^2}{\text{m}^2} \right) \frac{(160)(20)}{(0.4)(1.4)} \quad (3.3.4.2)$$

**A.3.4.2** The NFPA staff liaison should work with the submitting organization and NFPA legal counsel to ensure that all parties are properly referenced and credited for their materials.

**A.3.6.1** Where a cross-referenced section is divided into two or more subsections, such as 2.6.1, 2.6.2, and so forth, and paragraphs, such as 2.6.1.1, 2.6.1.2, and so forth, and where, for example, only 2.6.1.1 is relevant, the cross-reference should be to 2.6.1.1 only.

Such cross-references shall clearly indicate which subsections, paragraphs, or both are intended, such as 2.6.2 and 2.6.4 or 2.6.1.1 and 2.6.1.2.

**A.3.6.1.1.1** Examples of correct cross-reference to a chapter and a section are as follows:

Ducts shall be cleaned in accordance with the requirements of Chapter 6.

Valves shall be installed in accordance with Section 5.4.

**A.3.6.1.1.3** Examples of correct cross-references to subdivisions of a section are as follows:

Sprinklers shall meet the requirements of 4.6.2.

Hangers shall be installed in accordance with 4.6.7.5.

**A.3.6.1.1.4** Examples of nonmandatory cross-references within a document are as follows:

(see Section 2.3)

(See Annex D.)

**A.3.6.1.3** An example of an unneeded cross-reference is as follows:

Sprinklers used in water spray systems shall meet the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems*, Section 4.5.

If NFPA 13, Section 4.5 states "Sprinklers shall be listed" then the cross-reference is not needed and the wording could be changed to read as follows:

Sprinklers used in water spray systems shall be listed.

**A.3.6.2.2** References to proprietary documents of other organizations are particularly important in codes and standards that become regulations because the mandatory references become part of the regulations.

**A.3.6.3.1.1** The current edition for each reference is the most recent edition as of the date of the NFPA issuance of the document.

**A.3.7.1.7** Examples of credit lines are as follows:

(Courtesy of ABC Company)

(Photo by John Smith, XYZ Inc.)

**A.3.7.2.10.2** Turned or landscaped tables should be avoided to facilitate the transfer of document text to electronic media.

**A.3.7.3** An example of an equation is as follows:

The exposure variables, expressed in arithmetic form, are related by the following equation:

$$SRR = \left( \frac{OD}{l} \right) \left( \frac{T_b}{T_s} \right) V_s$$

$SRR$  = smoke release rate (m<sup>2</sup>/sec)

$OD$  = optical density (calculated as described in 8.1.1)

$l$  = path length for smoke measurement (duct diameter, m)

$T_b$  = temperature at the photoelectric cell (K)

$T_s$  = temperature at the bidirectional probe (K)

$V_s$  = volumetric flow rate (m<sup>3</sup>/sec)

**A.3.7.4.1** ANSI Y10 defines a letter symbol as "a single letter, specified as to general form or type for use within a mathematical expression." It continues, "the primary symbol may be modified by subscript or superscript. In a published work, the same primary letter symbol shall appear throughout for the same generic physical quantity, regardless of the units employed, and of special values assigned."

**A.3.7.4.3** A limiting literal subscript or superscript is part of the symbol itself even though it can actually be an abbreviation such as max or min.

**A.3.8.3.2** The following is an example of annex numbering:

**B.1.2 Test Specimens.**

**B.1.2.1 Handling.**

**B.2.2 Equipment.**

**A.3.9.1** When documents undergo a complete revision, changes are made to so many paragraphs that the document would require vertical rules and bullets throughout the entire document. If vertical rules and bullets would assist the user for a document that was completely revised, then the technical committee and/or staff liaison should consider their use.

**A.4.1.3** In some cases measurements are commonly expressed and internationally accepted only in one set of units. Where these unique measurements are expressed in inch-pound units, the addition of or conversion to SI units is not required. Where these unique measurements are expressed in SI units, the conversion to or addition of intensity, candela, are used internationally.

**A.4.2.1** The fundamental principle is that the intended accuracy and precision must be established before the value can be properly expressed. The basis of many requirements or recommendations are rooted in testing, measurement, analysis, or judgments that used or assumed a certain degree of accuracy and precision in their development. Maintaining the appropriate accuracy and precision requires knowledge of these factors and their development. The value expressed in a document for a measurement must reflect the accuracy and precision intended in this process. It should be noted that where the basis of a measurement is established primarily in one set of units (inch-pound units for example), it might not be appropriate for converted values to be "round" numbers unless they fall within the intended accuracy and precision established by the measurement basis.

**A.4.2.1.1** Where the basis for a specified measurement is imprecise, the accuracy and precision used to express the measurement must reflect this basis and not exaggerate the accuracy

intended for the measurement. The use of too many significant digits in expressing a measurement can imply a degree of precision greater than that intended for the measurement.

As an example, the basis of a measurement intends that item “a” be located “near” item “b.” However, a measurement value must be used to provide an enforceable requirement. A value of 5 ft is selected to allow some installation flexibility. Since the accuracy needed for this measurement is imprecise, the measurement could be expressed as 5 ft (1.5 m). Expressing the measurement with higher precision could imply an exaggerated accuracy that is not intended.

**A.4.2.1.2** Where the basis for a specified measurement is more precise, the accuracy and precision used to express the measurement should reflect this basis. The use of too few significant digits in expressing a measurement can degrade the intended accuracy.

**A.4.2.2** In the example used in A.4.2.1.1, the value expressed as 5 ft (1.5 m) implies an imprecise measurement. Note that difference in precision between the value expressed in inch-pound units and the value expressed in SI units suggests some leeway in judging how closely something must be measured. Also refer to A.4.3.1.

**A.4.3** The terms “hard” conversion and “soft” conversion have sometimes been used to describe types of conversion used in addressing conversions from inch-pound to metric units. These terms have often resulted in confusion in their application and therefore are not used within the mandatory portion of the *Manual of Style for NFPA Technical Committee Documents*. They are presented here for historical reference.

A “hard conversion is not a direct mathematical conversion but is considered a change in dimensions or properties of an item into new sizes that might or might not be interchangeable with the sizes used in the original measurement.

A “soft” conversion is considered a direct mathematical conversion and involves a change in the description of an existing measurement but not in the actual dimension.

Although the term “soft” conversion is often thought of as an “exact” conversion, this can be misleading since truly exact conversions are rare, and appropriate rounding of the converted value can result in a relatively inexact value.

**A.4.3.1** Because values are usually rounded, the value presented in one set of units will likely not agree exactly with the value presented in the other set of units. In the example used in A.4.2.1.1, the value of 1.5 m agrees with the value of 5 ft within the intended precision for the value. An exact conversion of 5 ft would be 1.524 m. The value expressed as 1.5 m is rounded to the nearest 0.1 m (3.94 in.), which is within the intended precision of a few inches.

**A.4.3.2** The use of rounded or imprecise values in any calculation can result in reduced accuracy to the output of the calculation. This is true for both simple conversions and for conversions involving more complex calculations. The following example demonstrates how a calculation can produce inaccurate results if the calculation uses numbers rounded to an inappropriate precision.

Determine the number of sprinklers needed to cover a 200 ft<sup>2</sup> design area protected by a dry-pipe sprinkler system.

Using inch-pound units:

Design area: 2000 ft<sup>2</sup>

Factor of 1.3 for dry-pipe sprinklers: 2000 ft<sup>2</sup> × 1.3 = 2600 ft<sup>2</sup>

Spacing used: 8 ft × 12 ft = 96 ft<sup>2</sup>

Number of sprinklers: 2600 ft<sup>2</sup> ÷ 96 ft<sup>2</sup> = 27.083

Rounding up: 28 sprinklers

Using SI units with “rounded” numbers:

Design area: 186 m<sup>2</sup>

Factor of 1.3 for dry-pipe sprinklers: 186 m<sup>2</sup> × 1.3 = 242 m<sup>2</sup>

Spacing used: 2.4 m × 3.6 m = 8.6 m<sup>2</sup>

Number of sprinklers: 242 m<sup>2</sup> ÷ 8.6 m<sup>2</sup> = 28.14

Rounding up: 29 sprinklers

Using SI units with more precise numbers:

Design area: 185.81 m<sup>2</sup>

Factor of 1.3 for dry-pipe sprinklers: 185.81 m<sup>2</sup> × 1.3 = 241.55 m<sup>2</sup>

Spacing used: 2.44 m × 3.66 m = 8.93 m<sup>2</sup>

Number of sprinklers: 241.55 m<sup>2</sup> ÷ 8.93 m<sup>2</sup> = 27.05

Rounding up: 28 sprinklers

Using SI units with even more precise numbers:

Design area: 185.806 m<sup>2</sup>

Factor of 1.3 for dry-pipe sprinklers: 185.806 m<sup>2</sup> × 1.3 = 241.548 m<sup>2</sup>

Spacing used: 2.438 m × 3.658 m = 8.919 m<sup>2</sup>

Number of sprinklers: 241.548 m<sup>2</sup> ÷ 8.919 m<sup>2</sup> = 27.082

Rounding up: 28 sprinklers

In the example above the most significant error appears to be in the conversion of the spacing value. Where converted values are used within the requirements or recommendations of a document, the acceptability of the resulting accuracy (or inaccuracy) of the calculation results must be reflective of accuracy and precision intended for the measurement and the basis used to establish them.

**A.4.3.4** When tolerances are used, conversion of measurement values will likely require a higher degree of precision than would otherwise be needed in order to maintain accurate and equivalent values.

Expanding on the example in A.4.2.1.1, if a higher degree of precision is intended, the measurement could be expressed as 60 in. (1.52 m). This implies a precision of an inch or less. (The precision implied by 1.52 m corresponds to less than an inch.)

The measurement could also be expressed using a specific tolerance such as 60 in. ± 1 in. (1.524 m ± 25 mm). Note that the value expressed in this way requires the converted value to be expressed with a higher degree of precision in order to maintain equivalence between the two numbers. For some measurement values the use of tolerances can be critical to maintaining the intended accuracy.

**A.4.3.5** Some dimensions used to identify commercial products involve the use of so-called nominal values or trade sizes. For example, lumber identified by the nominal dimensions 2 × 6 is not actually 2 in. by 6 in. These nominal dimensions provide a convenient means of designation or labeling, and conversion to equivalent SI units would not be appropriate. In these cases an appropriate counterpart trade size in the measurement system of conversion should be used instead. However, some trade sizes involve the use of precisely designated critical dimensions. Nuts and bolts and screw threads fall into this category. Conversion of these dimensions using an exact conversion of the critical dimension should be done for dimensional reference only. Where instead a counterpart trade size in the measurement system of conversion is used, care must be used to maintain the technical basis of the measurement.

**A.4.4** The following is suggested wording to make it clear how units of measure should be used during the application of the [document].

Where the convention in 4.1.1(1) is used:

#### **1.6 Units and Formulas.**

**1.6.1** The units of measure in this [document] are presented in the International System (SI) of Units.

**1.6.2** The values presented for measurements in this [document] are expressed with a degree of precision appropriate for practical application and enforcement. It is not intended that the application or enforcement of these values be more precise than the precision expressed.

**1.6.3** Where extracted text contains values expressed in only one system of units, the values in the extracted text have been retained without conversion to preserve the values established by the responsible technical committee in the source document.

Where the convention in 4.1.1(2) is used:

**1.6 Units and Formulas.**

**1.6.1** The units of measure in this [document] are presented in the International System (SI) of Units. Where presented, U.S. customary units (inch-pound units) follow the SI units in parentheses.

**1.6.2** Where both systems of units are presented, either system shall be acceptable for satisfying the [requirements, recommendations] in this [document].

**1.6.3** Where both systems of units are presented, users of this [document] shall apply one set of units consistently and shall not alternate between units.

**1.6.4** The values presented for measurements in this [document] are expressed with a degree of precision appropriate for practical application and enforcement. It is not intended that the application or enforcement of these values be more precise than the precision expressed.

**1.6.5** Where extracted text contains values expressed in only one system of units, the values in the extracted text have been retained without conversion to preserve the values established by the responsible technical committee in the source document.

Where the convention in 4.1.1(3) is used:

**1.6 Units and Formulas.**

**1.6.1** The units of measure in this [document] are presented first in U.S. customary units (inch-pound units). International System (SI) of Units follow the inch-pound units in parentheses.

**1.6.2** Either system of units shall be acceptable for satisfying the [requirements, recommendations] in the [document].

**1.6.3** Users of this [document] shall apply one system of units consistently and shall not alternate between units.

**1.6.4** The values presented for measurements in this [document] are expressed with a degree of precision appropriate for practical application and enforcement. It is not intended that the application or enforcement of these values be more precise than the precision expressed.

**1.6.5** Where extracted text contains values expressed in only one system of units, the values in the extracted text have been retained without conversion to preserve the values established by the responsible technical committee in the source document.

**Annex B SI Units and Conversions**

**B.1 Base Units and Derived Units.** The SI system consists of two classes of units: base and derived.

**B.1.1 SI Base Units.** Base units are the basis of the SI system and consist of seven dimensionally independent units that measure seven fundamental physical quantities. The SI base units are given in Table B.1.1.

**Table B.1.1 SI Base Units**

| Quantity                  | Unit     | Symbol |
|---------------------------|----------|--------|
| Length                    | meter    | m      |
| Mass                      | kilogram | kg     |
| Time                      | second   | s*     |
| Electric current          | ampere   | A      |
| Thermodynamic temperature | kelvin   | K      |
| Amount of a substance     | mole     | mol    |
| Luminous intensity        | candela  | cd     |

\*Where confusion might result, the symbol “sec” can be used.

**B.1.2 SI Derived Units.** All other units are “derived units” that are formed by combining the base units and units derived from them according to specific algebraic relations. Some derived units are provided with their own names, such as the unit for force, the “newton.” Others are named according to the units from which they are derived, such as the unit for velocity, “meter per second.” Table B.1.2(a) lists derived quantities that are provided with specially named SI units. Table B.1.2(b) lists those quantities without special names.

**Table B.1.2(a) SI Derived Units with Special Names**

| Quantity                                   | Unit           | Symbol Expressed in Terms of Other Units |                                    |
|--|----------------|--|------------------------------------|
| Absorbed dose                              | gray           | Gy                                       | J/kg                               |
| Activity (of radionuclide)                 | becquerel      | Bq                                       | 1/s                                |
| Angle, plane                               | radian         | rad                                      | m/m = 1                            |
| Angle, solid                               | steradian      | sr                                       | m <sup>2</sup> /m <sup>2</sup> = 1 |
| Celsius temperature                        | degree Celsius | °C                                       | K                                  |
| Dose equivalent                            | sievert        | Sv                                       | J/kg                               |
| Electrical capacitance                     | farad          | F  | C/V                                |
| Electrical charge, quantity of electricity | coulomb        | C  | A · s                              |
| Electrical conductance                     | siemens        | S  | A/V                                |
| Electrical inductance                      | henry          | H  | Wb/A                               |
| Electric potential difference              | volt           | V  | W/A                                |
| Electromotive force, electrical resistance | ohm            | Ω  | V/A                                |
| Energy, work, quantity of heat             | joule          | J  | N · m                              |
| Force                                      | newton         | N  | kg · m/s <sup>2</sup>              |
| Frequency                                  | hertz          | Hz                                       | 1/s                                |
| Illuminance                                | lux            | lx                                       | lm/m <sup>2</sup>                  |
| Luminous flux                              | lumen          | lm                                       | cd · sr                            |
| Magnetic flux                              | weber          | Wb                                       | V · s                              |
| Magnetic flux density                      | tesla          | T  | Wb/m <sup>2</sup>                  |
| Power, radiant flux                        | watt           | W  | J/s                                |
| Pressure, stress                           | pascal         | Pa                                       | N/m <sup>2</sup>                   |

**Table B.1.2(b) Other SI Derived Units**

| Quantity                     | Name                            | Symbol               |
|------------------------------|---------------------------------|----------------------|
| Absorbed dose rate           | gray per second                 | Gy/s                 |
| Acceleration                 | meter per second squared        | m/s <sup>2</sup>     |
| Angular acceleration         | radian per second squared       | rad/s <sup>2</sup>   |
| Angular velocity             | radian per second               | rad/s                |
| Area                         | square meter                    | m <sup>2</sup>       |
| Concentration                | mole per cubic meter            | mol/m <sup>3</sup>   |
| Current density              | ampere per square meter         | A/m <sup>2</sup>     |
| Density, mass                | kilogram per cubic meter        | kg/m <sup>3</sup>    |
| Electric charge density      | coulomb per cubic meter         | C/m <sup>3</sup>     |
| Electric field strength      | volt per meter                  | V/m                  |
| Electric flux density        | coulomb per square meter        | C/m <sup>2</sup>     |
| Energy density               | joule per cubic meter           | J/m <sup>3</sup>     |
| Entropy                      | joule per kelvin                | J/K                  |
| Exposure (x and gamma rays)  | coulomb per kilogram            | C/kg                 |
| Heat capacity                | joule per kelvin                | J/K                  |
| Heat flux density irradiance | watt per square meter           | W/m <sup>2</sup>     |
| Luminance                    | candela per square meter        | cd/m <sup>2</sup>    |
| Magnetic field strength      | ampere per meter                | A/m                  |
| Magnetic permeability        | henry per meter                 | H/m                  |
| Molar energy                 | joule per mole                  | J/mol                |
| Molar entropy                | joule per mole kelvin           | J/mol-K              |
| Molar heat capacity          | joule per mole kelvin           | J/mol-K              |
| Moment of force              | newton meter                    | N · m                |
| Permittivity                 | farad per meter                 | F/m                  |
| Power density                | watt per square meter           | W/m <sup>2</sup>     |
| Radiance                     | watt per square meter steradian | W/m <sup>2</sup> -sr |
| Radiant intensity            | watt per steradian              | W/sr                 |
| Specific energy              | joule per kilogram              | J/kg                 |
| Specific entropy             | joule per kilogram kelvin       | J/kg-K               |
| Specific heat capacity       | joule per kilogram kelvin       | J/kg-K               |
| Specific volume              | cubic meter per kilogram        | m <sup>3</sup> /kg   |
| Surface tension              | newton per meter                | N/m                  |
| Thermal conductivity         | watt per meter kelvin           | W/m-K                |
| Velocity                     | meter per second                | m/s                  |
| Viscosity, dynamic           | pascal second                   | Pa · s               |
| Viscosity, kinematic         | square meter per second         | m <sup>2</sup> /s    |
| Volume                       | cubic meter                     | m <sup>3</sup>       |
| Wave number                  | 1 per meter                     | 1/m                  |

**B.1.3 Units Used with SI.** The units given in Table B.1.3 are acceptable for use as SI units.

**Table B.1.3 Acceptable Units**

| Quantity                 | Unit                     | Symbol | Value in SI Units                  |
|--------------------------|--------------------------|--------|------------------------------------|
| Time                     | minute                   | min    | 60 s                               |
|                          | hour                     | hr     | 3600 s                             |
|                          | day                      | d      | 86,400 s                           |
| Plane angle              | degree                   | °      | 1° = (π/180) rad                   |
|                          | minute                   | '      | 1' = (1/60)°<br>= (π/10,800) rad   |
|                          | second                   | "      | 1" = (1/60)'<br>= (π/648,000) rad  |
| Volume (liquid)          | liter                    | L      | 10 <sup>-3</sup> m <sup>3</sup>    |
| Mass                     | metric ton or tonne      | t      | 10 <sup>3</sup> kg                 |
| Activity (radio-nuclide) | becquerel                | Bq     | 1/s                                |
| Energy                   | electron volt            | eV     | 1.602 177 33 × 10 <sup>-19</sup> J |
| Mass                     | unified atomic mass unit | u      | 1.660 540 2 × 10 <sup>-27</sup> kg |

**B.2 Energy.** The SI unit of energy is the joule (J).

**B.3 Area.** The SI unit for area is the square meter (m<sup>2</sup>). Large areas, such as measurement of land, can be expressed in hectares (ha), a special name for the hectometer, or in square kilometers (km<sup>2</sup>).

**B.4 Temperature Scales.** The SI unit for thermodynamic temperature is the kelvin (K). The degree Celsius (°C), which is equal to a kelvin in magnitude but used more extensively, should be used to express temperatures or temperature intervals in NFPA documents. Flash points of flammable liquids are commonly given in degrees Celsius (°C), as are the operating temperatures of sprinklers.

The relationship between °C and K is

$$K = °C + 273.15$$

Thus the boiling point of water is 100°C or 373 K.

A similar relationship exists between the measured temperature in degrees Fahrenheit (°F) and the thermodynamic temperature in degrees Rankine (°R) in U.S. customary units:

$$°R = °F + 459.7$$

The formulas for converting between °C and °F are as follows:

$$°F = °C \cdot (1.8) + 32$$

$$°C = \frac{(°F - 32)}{1.8}$$

*Example No. 1:* Under international transportation rules, flammable liquids are those whose flash points do not exceed 60.5°C. To convert to °F,

$^{\circ}\text{F} = (60.5)(1.8) + 32 = 140.9$ , usually rounded to  $141^{\circ}\text{F}$

*Example No. 2:* A sprinkler whose operating temperature is  $286^{\circ}\text{F}$  will fuse at a Celsius temperature of

$$^{\circ}\text{C} = \frac{(286 - 32)}{1.8} = \frac{254}{1.8} = 141^{\circ}\text{C}$$

Note that these two conversions apply to measured temperatures, not temperature differences.

To convert a temperature difference, the following formulas are used:

$$\Delta^{\circ}\text{F} = \Delta^{\circ}\text{C} \cdot (1.8)$$

$$\Delta^{\circ}\text{C} = \frac{\Delta^{\circ}\text{F}}{1.8}$$

*Example No. 3:* There are 100 Celsius degrees between the freezing and boiling points of water. On the Fahrenheit scale, there are

$$\Delta^{\circ}\text{F} = 100(1.8) = 180, \text{ or } 212 - 32$$

*Example No. 4:* A fire door must limit the temperature of the side not exposed to fire to not more than  $250^{\circ}\text{F}$  above ambient. In Celsius,

$$\Delta^{\circ}\text{C} = \frac{250}{1.8} = 138.8^{\circ}\text{C}, \text{ or } 139^{\circ}\text{C} \text{ (rounded)}$$

**B.5 Force and Mass.** The SI system uses two different units to express force and mass: kilogram (kg) for mass and newton (N) for force. It is important to distinguish whether one is converting a mass of material to the equivalent number of kilograms or a force to the equivalent value in newtons.

Mass:  $1 \text{ lb} = 0.45325 \text{ kg}$       Force:  $1 \text{ lb}_f = 4.448 \text{ N}$

The newton, not the kilogram, appears in force-related terms such as pressure ( $\text{N}/\text{m}^2$ ), energy ( $\text{N} \cdot \text{m} = \text{J}$ ), and power ( $\text{N} \cdot \text{m}/\text{s} = \text{J}/\text{s} = \text{W}$ ).

In commercial and common use, *weight* will be expressed as a synonym for *mass*. In this sense, *to weigh* means *to have a mass of*. For example, a typical box of breakfast cereal “weighs” 0.283 kg (10 oz).

A mass of 1 kg at the earth’s surface experiences a gravitational force of about 9.8 N. On the lunar surface, where the pull of gravity is  $1/6$  that of earth, the same 1-kg mass will experience a gravitational force of only about 1.6 N and would “weigh” only  $1/6$  of a kilogram.

In the U.S. customary system, a body with a mass of 20 *pounds* (a unit of mass) experiences a gravitational force of very nearly 20 *pound-force*. Because the numerical values and the unit names are so close, the distinction between the two units is not often appreciated. Indeed, although the unit “pound” appears in both terms, the unit “pound-force,” symbol “ $\text{lb}_f$ ,” is more accurate for the latter.

**B.6 Pressure.** The U.S. customary system expresses pressure in either gauge or absolute units, depending on whether the measurement is made relative to standard atmospheric pressure or to an absolute vacuum. These measures are identified by the familiar acronyms psig and psia for pounds per square inch, gauge and pounds per square inch, absolute, respectively. (Properly, pressure in U.S. customary units should be given as “ $x$  pounds force per square inch.”) No such conventions are allowed in the SI system.

For expressing a pressure differential, use of the unit kPa is sufficient. But where necessary to specify that a pressure measurement is relative to a standard atmosphere or to absolute vacuum, the measurement is qualified as follows:

... at a gauge pressure of 17.7 kPa

or

... at an absolute pressure of 1.4 kPa

Similarly, when metric equivalents are provided for U.S. customary units, the acronyms psig and psia should not be used, and the measurements should be stated as follows:

... at a gauge pressure of  $xx \text{ psi}$  ( $xx \text{ kPa}$ )

... at an absolute pressure of  $xx \text{ psi}$  ( $xx \text{ kPa}$ )

For example, in noting the difference between two pressure measurements, it is correct to state, “The pressures differ by 2.5 kPa.” This expression assumes that *both* measurements are relative to the same datum, either vacuum or atmospheric pressure. When stating the measurement of a particular gauge and it is not readily apparent whether the measurement is relative to vacuum or to atmospheric pressure, the datum should be stated as shown in the preceding examples.

## B.7 Prefixes.

**B.7.1 Prefix Use.** Standard prefixes are used to express SI units as multiples or submultiples of 10. In general, a prefix that limits the numerical value to a number between 0.1 and 1000 is used. For example, 28,000 meters is written 28 kilometers; 0.0017 grams is written 1.7 milligrams. However, exceptions to this general rule are given in Section B.8. Accepted SI prefixes are shown in Table B.7.1.

**Table B.7.1 Numerical Prefixes**

| Multiplication Factors | Prefix | Symbol |
|------------------------|--------|--------|
| $10^{24}$              | yotta  | Y      |
| $10^{21}$              | zetta  | Z      |
| $10^{18}$              | exa    | E      |
| $10^{15}$              | peta   | P      |
| $10^{12}$              | tera   | T      |
| $10^9$                 | giga   | G      |
| $10^6$                 | mega   | M      |
| $10^3 = 1000$          | kilo   | k      |
| $10^2 = 100$           | hecto  | h      |
| $10^1 = 10$            | deka   | da     |
| $10^0 = 1$             |        |        |
| $10^{-1} = 0.1$        | deci   | d      |
| $10^{-2} = 0.01$       | centi  | c      |
| $10^{-3} = 0.001$      | milli  | m      |
| $10^{-6}$              | micro  | $\mu$  |
| $10^{-9}$              | nano   | n      |
| $10^{-12}$             | pico   | p      |
| $10^{-15}$             | femto  | f      |
| $10^{-18}$             | atto   | a      |
| $10^{-21}$             | zepto  | z      |
| $10^{-24}$             | yocto  | y      |

### B.7.2 Prefix Conventions.

**B.7.2.1** In a table or in a discussion, the same multiple or magnitude of each unit should be used throughout. For example, millimeters and meters should not be mixed, or one or the other should be used.

**B.7.2.2** Millimeters (mm) should be used for linear dimensions instead of centimeters and when the accuracy of the measurement warrants its use, rather than fractions of a meter.

For example, “The bottom of the inlet shall be not more than 300 mm from the floor,” rather than “. . . not more than 0.3 m from the floor.”

**B.7.2.3** Centimeters should be used only for measurements of the human body or for clothing sizes.

**B.7.2.4** In forming a multiple of a compound unit (derived unit expressed in terms of two or more units), only the prefix, in the numerator, should be used.

For example kV/m is preferable to V/mm. Likewise, kg/m is preferable to g/cm<sup>3</sup>.

**B.7.2.5** Two or more prefixes should never be combined.

For example, 27 pF (picofarads), *not* 27  $\mu\mu$ F (micromicrofarads), is correct.

### B.8 Deviations from Strict SI.

**B.8.1 Spelling.** One departure from strict SI usage has been to use the spellings meter and liter instead of the internationally accepted metre and litre. The former terms are more commonly used and identified in certain parts of the world.

**B.8.2 Minute Versus Second.** A second difference is the use of liter per minute (L/min) and cubic meter per minute (m<sup>3</sup>/min) instead of the internationally accepted liter per second (L/s) and cubic meter per second (m<sup>3</sup>/s), particularly for measurements in hydraulics and water supply analysis. The minute was chosen over the second because L/min and m<sup>3</sup>/min more

nearly equate to gallons per minute, an easier quantity to use in fire protection engineering calculations.

Example: 1 gal/min = 3.8 L/min

1 m<sup>3</sup>/min = 1000 L/min

**B.8.3 Conversion Steps.** The following steps should be followed to retain the intended accuracy when converting units:

- (1) Establish the intended precision of the measurement. The intended precision is sometimes implied by the precision expressed in the original measurement. However, an estimate of precision is needed when the precision of the original measurement is not obvious. For example, if the original measurement was expressed as “a minimum of 80 in.,” the intended precision could be 10 in. ( $\pm 5$  in.), 1 in. ( $\pm 0.5$  in.), 0.1 in. ( $\pm 0.05$  in.) or other intended precision.
- (2) Use the appropriate conversion factor to obtain an exact (i.e., highly precise) conversion of the measurement value without rounding.
- (3) Use the appropriate conversion factor to obtain an exact (i.e., highly precise) conversion of the value of the intended precision without rounding.
- (4) Round the converted measurement value to obtain the intended precision. The number of significant digits should be such that the unit of the last place digit is equal to or less than the converted value of the intended precision. For example, if the intended precision for the measurement “a minimum of 80 in.” is 1 in., the precision expressed in the converted measurement value should be less than or equal to 1 in. The conversion of 80 in. would therefore be as follows:

1 in. [intended precision]

80 in.  $\times$  0.0254 m/in. = 2.032 m [exact conversion of measurement value]

1 in.  $\times$  25.4 mm/in. = 25.4 mm [exact conversion of intended precision]

Therefore rounding should be the nearest 10 mm [equal to or less than the intended precision].

The converted measurement value should be expressed as 2.03 in. [rounded to the nearest 10 mm].

- (5) Once the conversion is completed, the result should be compared to the measurement value upon which the conversion is based to confirm that the converted value and the original value are both expressed with the intended precision.

**B.8.4 Units Unique to Fire Protection.** The following units are unique to fire protection.

*Sprinkler Discharge Density.* Use liter per minute per square meter (L/min  $\cdot$  m<sup>2</sup>) in place of gallons per minute per square foot.

1 gpm/ft<sup>2</sup> = 40.746 mm<sup>3</sup>/min = 40.746 L/mm<sup>3</sup>  $\cdot$  m<sup>2</sup>

**B.9 Conversion Factors.** Two sets of multiplication factors that can assist in converting between U.S. customary units and SI units are shown in Table B.9(a) and Table B.9(b). These tables, taken from the *SFPE Handbook of Fire Protection Engineering*, third edition, include a list of units arranged alphabetically, in Table B.9(a), and a list arranged by physical quantity, in Table B.9(b) — that is, area, length, and so on. In the alphabetical list, the first two digits of each conversion factor represent the power of 10 by which the conversion factor must be multiplied. An asterisk indicates that the conversion factor is exact. All other conversion factors are either approximate or the result of physical measurements. The physical quantity list includes only those frequently used conversion factors. Additional conversion factors for many specialized units can be found in *Lange's Handbook of Chemistry*, fourteenth edition.

Table B.9(a) Conversion Factors Listed Alphabetically

| To Convert from                               | to                        | Multiply by            |
|---|---------------------------|------------------------|
| abampere                                      | ampere                    | +01 1.00*              |
| abcoulomb                                     | coulomb                   | +01 1.00*              |
| abfarad                                       | farad                     | +09 1.00*              |
| abhenry                                       | henry                     | -09 1.00*              |
| abmho   | siemens                   | +09 1.00*              |
| abohm   | ohm                       | -09 1.00*              |
| abvolt  | volt                      | -08 1.00*              |
| acre  | meter <sup>2</sup>        | +03 4.046 856 422 4*   |
| angstrom                                      | meter                     | -10 1.00*              |
| are   | meter <sup>2</sup>        | +02 1.00*              |
| astronomical unit (IAU)                       | meter                     | +11 1.496 00           |
| astronomical unit (radio)                     | meter                     | +11 1.495 978 9        |
| atmosphere                                    | newton/meter <sup>2</sup> | +05 1.013 25*          |
| bar   | newton/meter <sup>2</sup> | +05 1.00*              |
| barn  | meter <sup>2</sup>        | -28 1.00*              |
| barrel (petroleum, 42 gallons)                | meter <sup>3</sup>        | -01 1.589 873          |
| barye   | newton/meter <sup>2</sup> | -01 1.00*              |
| board foot (1' × 1' × 1")                     | meter <sup>3</sup>        | -03 2.359 737 216*     |
| British thermal unit:<br>(IST before 1956)    | joule                     | +03 1.055 04           |
| (IST after 1956)                              | joule                     | +03 1.055 056          |
| British thermal unit (mean)                   | joule                     | +03 1.055 87           |
| British thermal unit (thermochemical)         | joule                     | +03 1.054 350          |
| British thermal unit (39°F)                   | joule                     | +03 1.059 67           |
| British thermal unit (60°F)                   | joule                     | +03 1.054 68           |
| bushel (U.S.)                                 | meter <sup>3</sup>        | -02 3.523 907 016 688* |
| cable   | meter                     | +02 2.194 56*          |
| caliber                                       | meter                     | -04 2.54*              |
| calorie (International Steam Table)           | joule                     | +00 4.1868             |
| calorie (mean)                                | joule                     | +00 4.190 02           |
| calorie (thermochemical)                      | joule                     | +00 4.184*             |
| calorie (15°C)                                | joule                     | +00 4.185 80           |
| calorie (20°C)                                | joule                     | +00 4.181 90           |
| calorie (kilogram, International Steam Table) | joule                     | +03 4.1868             |
| calorie (kilogram, mean)                      | joule                     | +03 4.190 02           |
| calorie (kilogram, thermochemical)            | joule                     | +03 4.184*             |
| carat (metric)                                | kilogram                  | -04 2.00*              |
| Celsius (temperature)                         | kelvin                    | $t_K = t_C + 273.15$   |
| centimeter of mercury (0°C)                   | newton/meter <sup>2</sup> | +03 1.333 22           |
| centimeter of water (4°C)                     | newton/meter <sup>2</sup> | +01 9.806 38           |
| chain (engineer or ramden)                    | meter                     | +01 3.048*             |
| chain (surveyor or gunter)                    | meter                     | +01 2.011 68*          |
| circular mil                                  | meter <sup>2</sup>        | -10 5.067 074 8        |
| cord  | meter <sup>3</sup>        | +00 3.624 556 3        |
| cubit   | meter                     | -01 4.572*             |
| cup   | meter <sup>3</sup>        | -04 2.365 882 365*     |
| curie   | disintegration/second     | +10 3.70*              |

Table B.9(a) *Continued*

| To Convert from                 | to                         | Multiply by                 |
|---------------------------------|----------------------------|-----------------------------|
| day (mean solar)                | second (mean solar)        | +04 8.64*                   |
| day (sidereal)                  | second (mean solar)        | +04 8.616 409 0             |
| degree (angle)                  | radian                     | -02 1.745 329 251 994 3     |
| denier (international)          | kilogram/meter             | -07 1.00*                   |
| dram (avoirdupois)              | kilogram                   | -03 1.771 845 195 312 5*    |
| dram (troy or apothecary)       | kilogram                   | -03 3.887 934 6*            |
| dram (U.S. fluid)               | meter <sup>3</sup>         | -06 3.696 691 195 312 5*    |
| dyne                            | newton                     | -05 1.00*                   |
| electron volt                   | joule                      | -19 1.602 191 7             |
| erg                             | joule                      | -07 1.00*                   |
| Fahrenheit (temperature)        | kelvin                     | $t_K = (5/9)(t_F + 459.67)$ |
| Fahrenheit (temperature)        | Celsius                    | $t_C = (5/9)(t_F - 32)$     |
| faraday (based on carbon 12)    | coulomb                    | +04 9.68 70                 |
| faraday (chemical)              | coulomb                    | +04 9.649 57                |
| faraday (physical)              | coulomb                    | +04 9.652 19                |
| fathom                          | meter                      | +00 1.828 8*                |
| fermi (femtometer)              | meter                      | +15 1.00*                   |
| fluid ounce (U.S.)              | meter <sup>3</sup>         | -05 2.957 352 967 25*       |
| foot                            | meter                      | -01 3.048*                  |
| foot (U.S. survey)              | meter                      | +00 1200/3937*              |
| foot (U.S. survey)              | meter                      | -01 3.048 006 096           |
| foot of water (39.2°F)          | newton/meter <sup>2</sup>  | +03 2.988 98                |
| footcandle                      | lumen/meter <sup>2</sup>   | +01 1.076 391 0             |
| footlambert                     | candela/meter <sup>2</sup> | +00 3.426 259               |
| free fall, standard             | meter/second <sup>2</sup>  | +00 9.806 65*               |
| furlong                         | meter                      | +02 2.011 68*               |
| gal (galileo)                   | meter/second <sup>2</sup>  | -02 1.00*                   |
| gallon (U.K. liquid)            | meter <sup>3</sup>         | -03 4.546 087               |
| gallon (U.S. dry)               | meter <sup>3</sup>         | -03 4.404 883 770 86*       |
| gallon (U.S. liquid)            | meter <sup>3</sup>         | -03 3.785 411 784*          |
| gamma                           | tesla                      | -09 1.00*                   |
| gauss                           | tesla                      | -04 1.00*                   |
| gilbert                         | ampere turn                | -01 7.957 747 2             |
| gill (U.S.)                     | meter <sup>3</sup>         | -04 1.182 941 2             |
| gill (U.K.)                     | meter <sup>3</sup>         | -04 1.420 652               |
| grad                            | degree (angular)           | +00 9.00*                   |
| grad                            | radian                     | -02 1.570 796 3             |
| grain                           | kilogram                   | -05 6.479 891*              |
| gram                            | kilogram                   | -03 1.00*                   |
| hand                            | meter                      | -01 1.016*                  |
| hectare                         | meter <sup>3</sup>         | +04 1.00*                   |
| hogshead (U.S.)                 | meter <sup>3</sup>         | -01 2.384 809 423 92*       |
| horsepower (550 ft. lbf/second) | watt                       | +02 7.456 998 7             |
| horsepower (boiler)             | watt                       | +03 9.809 50                |
| horsepower (electric)           | watt                       | +02 7.46*                   |
| horsepower (metric)             | watt                       | +02 7.354 99                |
| horsepower (U.K.)               | watt                       | +02 7.457                   |
| horsepower (water)              | watt                       | +02 7.460 43                |
| hour (mean solar)               | second (mean solar)        | +03 3.60*                   |
| hour (sidereal)                 | second (mean solar)        | +03 3.590 170 4             |
| hundredweight (long)            | kilogram                   | +01 5.080 234 544*          |
| hundredweight (short)           | kilogram                   | +01 4.535 923 7*            |
| inch                            | meter                      | -02 2.54*                   |
| inch of mercury (32°F)          | newton/meter <sup>2</sup>  | +03 3.386 389               |
| inch of mercury (60°F)          | newton/meter <sup>2</sup>  | +03 3.375 85                |
| inch of water (39.2°F)          | newton/meter <sup>2</sup>  | +02 2.490 82                |
| inch of water (60°F)            | newton/meter <sup>2</sup>  | +02 2.4884                  |
| kayser                          | 1/meter                    | +02 1.00*                   |

(continues)



Table B.9(a) *Continued*

| To Convert from                         | to                               | Multiply by              |
|---|----------------------------------|--------------------------|
| kilocalorie (International Steam Table) | joule                            | +03 4.186 8              |
| kilocalorie (mean)                      | joule                            | +03 4.190 02             |
| kilocalorie (thermochemical)            | joule                            | +03 4.184*               |
| kilogram mass                           | kilogram                         | +00 1.00*                |
| kilogram force (kgf)                    | newton                           | +00 9.806 65*            |
| kilopound force                         | newton                           | +00 9.806 65*            |
| kip                                     | newton                           | +03 4.448 221 615 260 5* |
| knot (international)                    | meter/second                     | -01 5.144 444 444        |
| lambert                                 | candela/meter <sup>2</sup>       | +04 1/π*                 |
| lambert                                 | candela/meter <sup>2</sup>       | +03 3.183 098 8          |
| langley                                 | joule/meter <sup>2</sup>         | +04 4.184*               |
| lbf (pound force, avoirdupois)          | newton                           | +00 4.448 221 615 260 5* |
| lbm (pound mass, avoirdupois)           | kilogram                         | -01 4.535 923 7*         |
| league (U.K. nautical)                  | meter                            | +03 5.559 552*           |
| league (international nautical)         | meter                            | +03 5.556*               |
| league (statute)                        | meter                            | +03 4.828 032*           |
| light year                              | meter                            | +15 9.460 55             |
| link (engineer or ramden)               | meter                            | -01 3.048*               |
| link (surveyor or gunter)               | meter                            | -01 2.011 68*            |
| liter                                   | meter <sup>3</sup>               | -03 1.00*                |
| lux                                     | lumen/meter <sup>2</sup>         | +00 1.00*                |
| maxwell                                 | weber                            | -08 1.00*                |
| meter                                   | wavelengths Kr 86                | +06 1.650 763 73*        |
| micron                                  | meter                            | -06 1.00*                |
| mil                                     | meter                            | -05 2.54*                |
| mile (U.S. statute)                     | meter                            | +03 1.609 344*           |
| mile (U.K. nautical)                    | meter                            | +03 1.853 184*           |
| mile (international nautical)           | meter                            | +03 1.852*               |
| mile (U.S. nautical)                    | meter                            | +03 1.852*               |
| millibar                                | newton/meter <sup>2</sup>        | +02 1.00*                |
| millimeter of mercury (0°C)             | newton/meter <sup>2</sup>        | +02 1.333 224            |
| minute (angle)                          | radian                           | -04 2.908 882 086 66     |
| minute (mean solar)                     | second (mean solar)              | +01 6.00*                |
| minute (sidereal)                       | second (mean solar)              | +01 5.983 617 4          |
| month (mean calendar)                   | second (mean solar)              | +06 2.628*               |
| nautical mile (international)           | meter                            | +03 1.852*               |
| nautical mile (U.S.)                    | meter                            | +03 1.852*               |
| nautical mile (U.K.)                    | meter                            | +03 1.853 184*           |
| oersted                                 | ampere/meter                     | +01 7.957 747 2          |
| ounce force (avoirdupois)               | newton                           | -01 2.780 138 5          |
| ounce mass (avoirdupois)                | kilogram                         | -02 2.834 952 312 5*     |
| ounce mass (troy or apothecary)         | kilogram                         | -02 3.110 347 68*        |
| ounce (U.S. fluid)                      | meter <sup>3</sup>               | -05 2.957 352 956 25*    |
| pace                                    | meter                            | -01 7.62*                |
| parsec (IAU)                            | meter                            | +16 3.085 7              |
| pascal                                  | newton/meter <sup>2</sup>        | +00 1.00*                |
| peck (U.S.)                             | meter <sup>3</sup>               | -03 8.809 767 541 72*    |
| pennyweight                             | kilogram                         | -03 1.555 173 84*        |
| perch                                   | meter                            | +00 5.0292*              |
| phot                                    | lumen/meter <sup>2</sup>         | +04 1.00                 |
| pica (printers)                         | meter                            | -03 4.217 517 6*         |
| pint (U.S. dry)                         | meter <sup>3</sup>               | -04 5.506 104 713 575*   |
| pint (U.S. liquid)                      | meter <sup>3</sup>               | -04 4.731 764 73*        |
| point (printers)                        | meter                            | -04 3.514 598*           |
| poise                                   | newton second/meter <sup>2</sup> | -01 1.00*                |
| pole                                    | meter                            | +00 5.0292*              |
| pound force (lbf avoirdupois)           | newton                           | +00 4.448 221 615 260 5* |
| pound mass (lbm avoirdupois)            | kilogram                         | -01 4.535 923 7*         |

Table B.9(a) *Continued*

| To Convert from                           | to                                | Multiply by  |
|---|-----------------------------------|--|
| pound mass (troy or apothecary)           | kilogram                          | -01 3.732 417 216*                                 |
| poundal                                   | newton                            | -01 1.382 549 543 76*                              |
| quart (U.S. dry)                          | meter <sup>3</sup>                | -03 1.101 220 942 715*                             |
| quart (U.S. liquid)                       | meter <sup>3</sup>                | -04 9.463 592 5                                    |
| rad (radiation dose absorbed)             | joule/kilogram                    | -02 1.00*  |
| Rankine (temperature)                     | kelvin                            | $t_K = (5/9)t_R$                                   |
| rayleigh (rate of photon emission)        | 1/second meter <sup>2</sup>       | +10 1.00*  |
| rhe                                       | meter <sup>2</sup> /newton second | +01 1.00*  |
| rod                                       | meter                             | +00 5.0292*  |
| roentgen                                  | coulomb/kilogram                  | -04 2.579 76*                                      |
| rutherford                                | disintegration/second             | +06 1.00*  |
| second (angle)                            | radian                            | +06 4.848 136 811                                  |
| second (ephemeris)                        | second                            | +00 1.000 000 000                                  |
| second (mean solar)                       | second (ephemeris)                | Consult American Ephemeris<br>and Nautical Almanac |
| second (sidereal)                         | second (mean solar)               | -01 9.972 695 7                                    |
| section                                   | meter <sup>2</sup>                | +06 2.589 988 110 336*                             |
| scruple (apothecary)                      | kilogram                          | -03 1.295 978 2*                                   |
| shake                                     | second                            | -08 1.00   |
| skein                                     | meter                             | +02 1.097 28*                                      |
| slug                                      | kilogram                          | +01 1.459 390 29                                   |
| span                                      | meter                             | -01 2.286*   |
| statampere                                | ampere                            | -10 3.335 640                                      |
| statcoulomb                               | coulomb                           | -10 3.335 640                                      |
| statfarad                                 | farad                             | -12 1.112 650                                      |
| stathenry                                 | henry                             | +11 8.987 554                                      |
| statohm                                   | ohm                               | +11 8.987 554                                      |
| statute mile (U.S.)                       | meter                             | +03 1.609 344*                                     |
| statvolt                                  | volt                              | +02 2.997 925                                      |
| stere                                     | meter                             | +00 1.00*  |
| stilb                                     | candela/meter <sup>2</sup>        | +04 1.00   |
| stoke                                     | meter <sup>2</sup> /second        | -04 1.00*  |
| tablespoon                                | meter <sup>3</sup>                | -05 1.478 676 478 125*                             |
| teaspoon                                  | meter <sup>3</sup>                | -06 4.928 921 593 75*                              |
| ton (assay)                               | kilogram                          | -02 2.196 666 6                                    |
| ton (long)                                | kilogram                          | +03 1.016 046 908 8*                               |
| ton (metric)                              | kilogram                          | +03 1.00*  |
| ton (nuclear equivalent of TNT)           | joule                             | +09 4.20   |
| ton (register)                            | meter <sup>3</sup>                | +00 2.831 684 659 2*                               |
| ton (short, 2000 pound)                   | kilogram                          | +02 9.071 847 4*                                   |
| tonne                                     | kilogram                          | +03 1.00*  |
| torr (0°C)                                | newton/meter <sup>2</sup>         | +02 1.333 22                                       |
| township                                  | meter <sup>2</sup>                | +07 9.323 957 2                                    |
| unit pole                                 | weber                             | -07 1.256 637                                      |
| yard                                      | meter                             | -01 9.144*   |
| year (calendar)                           | second (mean solar)               | +07 3.1536*  |
| year (sidereal)                           | second (mean solar)               | +07 3.155 815 0                                    |
| year (tropical)                           | second (mean solar)               | +07 3.155 692 6                                    |
| year 1900, tropical, Jan., day 0, hour 12 | second (ephemeris)                | +07 3.155 692 597 47*                              |
| year 1900, tropical, Jan., day 0, hour 12 | second                            | +07 3.155 692 597 47                               |

(continues)

Table B.9(b) Conversion Factors Listed by Physical Quantity

| To Convert from                                 | to                          | Multiply by            |
|---|-----------------------------|------------------------|
| <b>ACCELERATION</b>                             |                             |                        |
| foot/second <sup>2</sup>                        | meter/second <sup>2</sup>   | -01 3.048*             |
| free fall, standard                             | meter/second <sup>2</sup>   | +00 9.806 65*          |
| gal (galileo)                                   | meter/second <sup>2</sup>   | -02 1.00*              |
| inch/second <sup>2</sup>                        | meter/second <sup>2</sup>   | -02 2.54*              |
| <b>AREA</b>                                     |                             |                        |
| acre  | meter <sup>2</sup>          | +03 4.046 856 422 4*   |
| are   | meter <sup>2</sup>          | +02 1.00*              |
| barn  | meter <sup>2</sup>          | -28 1.00*              |
| circular mil                                    | meter <sup>2</sup>          | -10 5.067 074 8        |
| foot <sup>2</sup>                               | meter <sup>2</sup>          | -02 9.290 304*         |
| hectare   | meter <sup>2</sup>          | +04 1.00*              |
| inch <sup>2</sup>                               | meter <sup>2</sup>          | -04 6.4516*            |
| mile <sup>2</sup> (U.S. statute)                | meter <sup>2</sup>          | +06 2.589 988 110 336* |
| section   | meter <sup>2</sup>          | +06 2.589 988 110 336* |
| township  | meter <sup>2</sup>          | +07 9.323 957 2        |
| yard <sup>2</sup>                               | meter <sup>2</sup>          | -01 8.361 273 6*       |
| <b>DENSITY</b>                                  |                             |                        |
| gram/centimeter <sup>3</sup>                    | kilogram/meter <sup>3</sup> | -03 1.00*              |
| lbm/inch <sup>3</sup>                           | kilogram/meter <sup>3</sup> | +04 2.767 990 5        |
| lbm/foot <sup>3</sup>                           | kilogram/meter <sup>3</sup> | +01 1.601 846 3        |
| slug/foot <sup>3</sup>                          | kilogram/meter <sup>3</sup> | +02 5.153 79           |
| <b>ENERGY</b>                                   |                             |                        |
| British thermal unit:<br>(IST before 1956)      | joule                       | +03 1.055 04           |
| (IST after 1956)                                | joule                       | +03 1.055 056          |
| British thermal unit (mean)                     | joule                       | +03 1.055 87           |
| British thermal unit (thermochemical)           | joule                       | +03 1.054 350          |
| British thermal unit (39°F)                     | joule                       | +03 1.059 67           |
| British thermal unit (60°F)                     | joule                       | +03 1.054 68           |
| calorie (International Steam Table)             | joule                       | +00 4.1868             |
| calorie (mean)                                  | joule                       | +00 4.190 02           |
| calorie (thermochemical)                        | joule                       | +00 4.184*             |
| calorie (15°C)                                  | joule                       | +00 4.185 80           |
| calorie (27°C)                                  | joule                       | +00 4.181 90           |
| calorie (kilogram, International Steam Table)   | joule                       | +03 4.1868             |
| calorie (kilogram, mean)                        | joule                       | +03 4.190 02           |
| calorie (kilogram, thermochemical)              | joule                       | +03 4.184*             |
| electron volt                                   | joule                       | -19 1.602 191 7        |
| erg   | joule                       | -07 1.00*              |
| foot lbf  | joule                       | +03 1.355 817 9        |
| foot poundal                                    | joule                       | -02 4.214 011 0        |
| joule (international of 1948)                   | joule                       | +00 1.000 165          |
| kilocalorie (International Steam Table)         | joule                       | +03 4.1868             |
| kilocalorie (mean)                              | joule                       | +03 4.190 02           |
| kilocalorie (thermochemical)                    | joule                       | +03 4.184*             |
| kilowatt hour                                   | joule                       | +06 3.60*              |
| kilowatt hour (international of 1948)           | joule                       | +06 3.600 59           |
| ton (nuclear equivalent of TNT)                 | joule                       | +09 4.20               |
| watt hour                                       | joule                       | +03 3.60*              |
| <b>ENERGY/AREA TIME</b>                         |                             |                        |
| Btu (thermochemical)/foot <sup>2</sup> second   | watt/meter <sup>2</sup>     | +04 1.134 893 1        |
| Btu (thermochemical)/foot <sup>2</sup> minute   | watt/meter <sup>2</sup>     | +02 1.891 488 5        |
| Btu (thermochemical)/foot <sup>2</sup> hour     | watt/meter <sup>2</sup>     | +00 3.152 480 8        |
| Btu (thermochemical)/inch <sup>2</sup> second   | watt/meter <sup>2</sup>     | +06 1.634 246 2        |
| calorie (thermochemical)/cm <sup>2</sup> minute | watt/meter <sup>2</sup>     | +02 6.973 333 3        |
| erg/centimeter <sup>2</sup> second              | watt/meter <sup>2</sup>     | -03 1.00*              |
| watt/centimeter <sup>2</sup>                    | watt/meter <sup>2</sup>     | +04 1.00*              |

Table B.9(b) Continued

| To Convert from                      | to                | Multiply by              |
|--------------------------------------|-------------------|--------------------------|
| <b>FORCE</b>                         |                   |                          |
| dyne                                 | newton            | -05 1.00*                |
| kilogram force (kgf)                 | newton            | +00 9.806 65*            |
| kilopound force                      | newton            | +00 9.806 65*            |
| kip                                  | newton            | +03 4.448 221 615 260 5* |
| lbf (pound force, avoirdupois)       | newton            | +00 4.448 221 615 260 5* |
| ounce force (avoirdupois)            | newton            | +01 2.780 138 5          |
| pound force, lbf (avoirdupois)       | newton            | +00 4.448 221 615 260 5* |
| poundal                              | newton            | -01 1.382 549 543 76*    |
| <b>LENGTH</b>                        |                   |                          |
| angstrom                             | meter             | -10 1.00*                |
| astronomical unit (IAU)              | meter             | +11 1.496 00             |
| astronomical unit (radio)            | meter             | +11 1.495 978 9          |
| cable                                | meter             | +02 2.194 56*            |
| caliber                              | meter             | -04 2.54*                |
| chain (surveyor or gunter)           | meter             | +01 2.011 68*            |
| chain (engineer or ramden)           | meter             | +01 3.048*               |
| cubit                                | meter             | -01 4.572*               |
| fathom                               | meter             | +00 1.8288*              |
| fermi (femtometer)                   | meter             | -15 1.00*                |
| foot                                 | meter             | -01 3.048*               |
| foot (U.S. survey)                   | meter             | +00 1200/3937*           |
| foot (U.S. survey)                   | meter             | -01 3.048 006 096        |
| furlong                              | meter             | +02 2.011 68*            |
| hand                                 | meter             | -01 1.016*               |
| inch                                 | meter             | -02 2.54*                |
| league (U.K. nautical)               | meter             | +03 5.559 552*           |
| league (international nautical)      | meter             | +03 5.556*               |
| league (statute)                     | meter             | +03 4.828 032*           |
| lightyear                            | meter             | +15 9.460 55             |
| link (engineer or ramden)            | meter             | -01 3.048*               |
| link (surveyor or gunter)            | meter             | -01 2.011 68*            |
| meter                                | wavelengths Kr 86 | +06 1.650 763 73*        |
| micron                               | meter             | -06 1.00*                |
| mil                                  | meter             | -05 2.54*                |
| mile (U.S. statute)                  | meter             | +03 1.609 344*           |
| mile (U.K. nautical)                 | meter             | +03 1.853 184*           |
| mile (international nautical)        | meter             | +03 1.852*               |
| mile (U.S. nautical)                 | meter             | +03 1.852*               |
| nautical mile (U.K.)                 | meter             | +03 1.853 184*           |
| nautical mile (international)        | meter             | +03 1.852*               |
| nautical mile (U.S.)                 | meter             | +03 1.852*               |
| pace                                 | meter             | -01 7.62*                |
| parsec (IAU)                         | meter             | +16 3.085 7              |
| perch                                | meter             | +00 5.0292*              |
| pica (printers)                      | meter             | -03 4.217 517 6*         |
| point (printers)                     | meter             | -04 3.514 598*           |
| pole                                 | meter             | +00 5.0292*              |
| rod                                  | meter             | +00 5.0292*              |
| skein                                | meter             | +02 1.097 28*            |
| span                                 | meter             | -01 2.286*               |
| statute mile (U.S.)                  | meter             | +03 1.609 344*           |
| yard                                 | meter             | -01 9.144*               |
| <b>MASS</b>                          |                   |                          |
| carat (metric)                       | kilogram          | -04 2.00*                |
| gram (avoirdupois)                   | kilogram          | -03 1.771 845 195 312 5* |
| gram (troy or apothecary)            | kilogram          | -03 3.887 934 6*         |
| grain                                | kilogram          | -05 6.479 891*           |
| gram                                 | kilogram          | -03 1.00*                |
| hundredweight (long)                 | kilogram          | +01 5.080 234 544*       |
| hundredweight (short)                | kilogram          | +01 4.535 923 7*         |
| kgf second <sup>2</sup> meter (mass) | kilogram          | +00 9.806 65*            |
| kilogram mass                        | kilogram          | +00 1.00*                |
| lbm (pound mass, avoirdupois)        | kilogram          | -01 4.535 923 7*         |

(continues)

Table B.9(b) *Continued*

| To Convert from                     | to                        | Multiply by           |
|-------------------------------------|---------------------------|-----------------------|
| <b>MASS (continued)</b>             |                           |                       |
| ounce mass (avoirdupois)            | kilogram                  | -02 2.834 952 312 5*  |
| ounce mass (troy or apothecary)     | kilogram                  | -02 3.110 347 68*     |
| pennyweight                         | kilogram                  | -03 1.555 173 84*     |
| pound mass, lbm (avoirdupois)       | kilogram                  | -01 4.535 923 7*      |
| pound mass (troy or apothecary)     | kilogram                  | -01 3.732 417 216*    |
| scruple (apothecary)                | kilogram                  | -03 1.295 978 2*      |
| slug                                | kilogram                  | +01 1.459 390 29      |
| ton (assay)                         | kilogram                  | -02 2.196 666 6       |
| ton (long)                          | kilogram                  | +03 1.016 046 908 8*  |
| ton (metric)                        | kilogram                  | +03 1.00*             |
| ton (short, 2000 pound)             | kilogram                  | +02 9.071 847 4*      |
| tonne                               | kilogram                  | +03 1.00*             |
| <b>POWER</b>                        |                           |                       |
| Btu (thermochemical)/second         | watt                      | +03 1.054 350 264 488 |
| Btu (thermochemical)/minute         | watt                      | +01 1.757 250 4       |
| calorie (thermochemical)/second     | watt                      | +00 4.184*            |
| calorie (thermochemical)/minute     | watt                      | -02 6.973 333 3       |
| foot lbf/hour                       | watt                      | -04 3.766 161 0       |
| foot lbf/minute                     | watt                      | -02 2.259 696 6       |
| foot lbf/second                     | watt                      | +00 1.355 817 9       |
| horsepower (550 ft • lbf/second)    | watt                      | +02 7.456 998 7       |
| horsepower (boiler)                 | watt                      | +03 9.809 50          |
| horsepower (electric)               | watt                      | +02 7.46*             |
| horsepower (metric)                 | watt                      | +02 7.354 99          |
| horsepower (U.K.)                   | watt                      | +02 7.457             |
| horsepower (water)                  | watt                      | +02 7.460 43          |
| kilocalorie (thermochemical)/minute | watt                      | +01 6.973 333 3       |
| kilocalorie (thermochemical)/second | watt                      | +03 4.184*            |
| watt (international of 1948)        | watt                      | +00 1.000 165         |
| <b>PRESSURE</b>                     |                           |                       |
| atmosphere                          | newton/meter <sup>2</sup> | +05 1.013 25*         |
| bar                                 | newton/meter <sup>2</sup> | +05 1.00*             |
| barye                               | newton/meter <sup>2</sup> | -01 1.00*             |
| centimeter of mercury (0°C)         | newton/meter <sup>2</sup> | +03 1.333 22          |
| centimeter of water (4°C)           | newton/meter <sup>2</sup> | +01 9.806 38          |
| dyne/centimeter <sup>2</sup>        | newton/meter <sup>2</sup> | -01 1.00*             |
| foot of water (39.2°F)              | newton/meter <sup>2</sup> | +03 2.988 988         |
| inch of mercury (32°F)              | newton/meter <sup>2</sup> | +03 3.386 389         |
| inch of mercury (60°F)              | newton/meter <sup>2</sup> | +03 3.376 85          |
| inch of water (39.2°F)              | newton/meter <sup>2</sup> | +02 2.480 82          |
| inch of water (60°F)                | newton/meter <sup>2</sup> | +02 2.4884            |
| kgf/centimeter <sup>2</sup>         | newton/meter <sup>2</sup> | +04 9.806 65*         |
| kgf/meter <sup>2</sup>              | newton/meter <sup>2</sup> | +00 9.806 65*         |
| lbf/foot <sup>2</sup>               | newton/meter <sup>2</sup> | +01 4.788 025 8       |
| lbf/inch <sup>2</sup> (psi)         | newton/meter <sup>2</sup> | +03 6.894 757 2       |
| millibar                            | newton/meter <sup>2</sup> | +02 1.00*             |
| millimeter of mercury (0°C)         | newton/meter <sup>2</sup> | +02 1.333 224         |
| pascal                              | newton/meter <sup>2</sup> | +00 1.00*             |
| psi (lbf/inch <sup>2</sup> )        | newton/meter <sup>2</sup> | +03 6.894 757 2       |
| torr (0°C)                          | newton/meter <sup>2</sup> | +02 1.333 22          |
| <b>SPEED</b>                        |                           |                       |
| foot/hour                           | meter/second              | -05 8.466 666 6       |
| foot/minute                         | meter/second              | -03 5.08*             |
| foot/second                         | meter/second              | -01 3.048*            |
| inch/second                         | meter/second              | -02 2.54*             |
| kilometer/hour                      | meter/second              | -01 2.777 777 8       |
| knot (international)                | meter/second              | -01 5.144 444 444     |
| mile/hour (U.S. statute)            | meter/second              | -01 4.4704*           |
| mile/minute (U.S. statute)          | meter/second              | +01 2.682 24*         |
| mile/second (U.S. statute)          | meter/second              | +03 1.609 344*        |

Table B.9(b) Continued

| To Convert from                           | to                                | Multiply by                 |
|---|-----------------------------------|-----------------------------|
| <b>TEMPERATURE</b>                        |                                   |                             |
| Celsius                                   | kelvin                            | $t_K = t_C + 273.15$        |
| Fahrenheit                                | kelvin                            | $t_K = (5/9)(t_F + 459.67)$ |
| Fahrenheit                                | Celsius                           | $t_C = (5/9)(t_F - 32)$     |
| Rankine                                   | kelvin                            | $t_K = (5/9)t_R$            |
| <b>TIME</b>                               |                                   |                             |
| day (mean solar)                          | second (mean solar)               | +04 8.64*                   |
| day (sidereal)                            | second (mean solar)               | +04 8.616 409 0             |
| hour (mean solar)                         | second (mean solar)               | +03 3.60*                   |
| hour (sidereal)                           | second (mean solar)               | +03 3.590 170 4             |
| minute (mean solar)                       | second (mean solar)               | +01 6.00*                   |
| minute (sidereal)                         | second (mean solar)               | +01 5.983 617 4             |
| month (mean calendar)                     | second (mean solar)               | +06 2.628*                  |
| second (ephemeris)                        | second                            | +00 1.000 000 000           |
| second (sidereal)                         | second (mean solar)               | -01 9.972 695 7             |
| year (calendar)                           | second (mean solar)               | +07 3.1536*                 |
| year (sidereal)                           | second (mean solar)               | +07 3.155 815 0             |
| year (tropical)                           | second (mean solar)               | +07 3.155 692 6             |
| year 1900, tropical, Jan., day 0, hour 12 | second (ephemeris)                | +07 3.155 692 597 47*       |
| year 1900, tropical, Jan., day 0, hour 12 | second                            | +07 3.155 692 597 47        |
| <b>VISCOSITY</b>                          |                                   |                             |
| centistoke                                | meter <sup>2</sup> /second        | -06 1.00*                   |
| stoke                                     | meter <sup>2</sup> /second        | -04 1.00*                   |
| foot <sup>2</sup> /second                 | meter <sup>2</sup> /second        | -02 9.290 304*              |
| centipoise                                | newton second/meter <sup>2</sup>  | -03 1.00*                   |
| lbm/foot second                           | newton second/meter <sup>2</sup>  | +00 1.488 163 9             |
| lbf · second/foot <sup>2</sup>            | newton second/meter <sup>2</sup>  | +01 4.788 025 8             |
| poise                                     | newton second/meter <sup>2</sup>  | -01 1.00*                   |
| poundal second/foot <sup>2</sup>          | newton second/meter <sup>2</sup>  | +00 1.488 163 9             |
| slug/foot second                          | newton second/meter <sup>2</sup>  | +01 4.788 025 8             |
| rhe                                       | meter <sup>2</sup> /newton second | +01 1.00*                   |
| <b>VOLUME</b>                             |                                   |                             |
| acre foot                                 | meter <sup>3</sup>                | +03 1.233 481 837 547 52*   |
| barrel (petroleum, 42 gallons)            | meter <sup>3</sup>                | -01 1.589 873               |
| board foot                                | meter <sup>3</sup>                | -03 2.359 737 216*          |
| bushel (U.S.)                             | meter <sup>3</sup>                | -02 3.523 907 016 688*      |
| cord                                      | meter <sup>3</sup>                | +00 3.624 556 3             |
| cup                                       | meter <sup>3</sup>                | -04 2.365 882 365*          |
| dram (U.S. fluid)                         | meter <sup>3</sup>                | -06 3.696 691 195 312 5*    |
| fluid ounce (U.S.)                        | meter <sup>3</sup>                | -05 2.957 352 946 25*       |
| foot <sup>3</sup>                         | meter <sup>3</sup>                | -02 2.831 684 659 2*        |
| gallon (U.K. liquid)                      | meter <sup>3</sup>                | -03 4.546 087               |
| gallon (U.S. dry)                         | meter <sup>3</sup>                | -03 4.404 883 770 86*       |
| gallon (U.S. liquid)                      | meter <sup>3</sup>                | -03 3.785 411 784*          |
| gill (U.K.)                               | meter <sup>3</sup>                | -04 1.420 652               |
| gill (U.S.)                               | meter <sup>3</sup>                | -04 1.182 941 2             |
| hogshead (U.S.)                           | meter <sup>3</sup>                | -01 2.384 809 423 92*       |
| inch <sup>3</sup>                         | meter <sup>3</sup>                | -05 1.638 706 4*            |
| liter                                     | meter <sup>3</sup>                | -03 1.00*                   |
| ounce (U.S. fluid)                        | meter <sup>3</sup>                | -05 2.957 352 956 25*       |
| peck (U.S.)                               | meter <sup>3</sup>                | -03 8.809 767 541 72*       |
| pint (U.S. dry)                           | meter <sup>3</sup>                | -04 5.506 104 713 575*      |
| pint (U.S. liquid)                        | meter <sup>3</sup>                | -04 4.731 764 73*           |
| quart (U.S. dry)                          | meter <sup>3</sup>                | -03 1.101 220 942 715*      |
| quart (U.S. liquid)                       | meter <sup>3</sup>                | -04 9.463 592 5             |
| stere                                     | meter <sup>3</sup>                | +00 1.00*                   |
| tablespoon                                | meter <sup>3</sup>                | -05 1.478 676 478 125*      |
| teaspoon                                  | meter <sup>3</sup>                | -06 4.928 921 593 75*       |
| ton (register)                            | meter <sup>3</sup>                | +00 2.831 684 659 2*        |
| yard <sup>3</sup>                         | meter <sup>3</sup>                | -01 7.645 548 579 84*       |

**B.10 Units of Measure in Figures.****B.10.1 Editorial Conventions.**

The following general editorial conventions apply to figures:

- (1) Symbols for units of measure should be in roman, not italic, type.
- (2) Do not follow symbols with a period except at the end of a sentence.
- (3) Insert a space between the numerical value and the symbol — for example, 3 kg.
- (4) Do not insert a space between the numerical value and the symbol for measurements of plane angles (degree, minute, second).
- (5) Do not insert a space between prefix and unit symbols — for example, kg, not k g.
- (6) Do not use abbreviations for units; use the unit symbol — for example, use A, not amp, for ampere.
- (7) Use unit symbols instead of unit names, especially for complex mathematical expressions. Spell out unit names in text where confusion might result. For example, “min” could be interpreted as “minimum” rather than “minute.”
- (8) Do not mix unit symbols and unit names in the same expression or sentence.

**B.10.2 Units Formed by Multiplication and Division.**

**B.10.2.1 Product.** Use a space or a hyphen for unit names — for example, newton meter or newton-meter. The space is preferred. Use a dot (·) for the unit symbol — for example, N·m.

**B.10.2.2 Quotient.** Use the word *per* for unit names — for example, meters per second.

Use a slash (/) or the appropriate power for unit symbols — for example, m/s or  $m \cdot s^{-1}$ .

**B.10.2.3 Multiple Quotient.** Use a dot (·) instead of second slash for multiple quotients — for example, L/min · m<sup>2</sup> instead of L/min/m<sup>2</sup>.

**B.10.3 Decimal Marker.** In most other countries, the comma is used as the decimal marker. In the United States, the customary symbol is a dot or period, and the comma is used to separate digits into groups of three.

**B.10.4 Billion.** In the United States, “billion” means thousand million (giga). In most other countries, it means million million (tera). Do not use this term. Use powers of 10 instead.

**B.10.5 Roman Numerals.** Do not use roman numerals, because they might be misinterpreted as SI prefixes.

## Index

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