

HOW TO USE THE *NATIONAL ELECTRICAL CODE*

The original *NEC* document was developed in 1897 as a result of the united efforts of various insurance, electrical, architectural, and other cooperative interests. The National Fire Protection Association (NFPA) has sponsored the *National Electrical Code* since 1911.

The purpose of the *Code* is the practical safeguarding of persons and property from hazards arising from the use of electricity. It isn't intended as a design specification or an instruction manual for untrained persons. It is, in fact, a standard that contains the minimum requirements for an electrical installation that's essentially free from hazard. Learning to understand and use the *Code* is critical to you working safely; whether you're training to become an electrician, or are already an electrician, electrical contractor, inspector, engineer, designer, or instructor.

The *NEC* was written for qualified persons; those who understand electrical terms, theory, safety procedures, and electrical trade practices. Learning to use the *Code* is a lengthy process and can be frustrating if you don't approach it the right way. First, you'll need to understand electrical theory and if you don't have theory as a background when you get into the *NEC*, you're going to struggle. Take one step back if necessary and learn electrical theory. You must also understand the concepts and terms in the *Code* and know grammar and punctuation in order to understand the complex structure of the rules and their intended purpose(s). The *NEC* is written in a formal outline which many of us haven't seen or used since high school or college so it's important for you to pay particular attention to this format. Our goal for the next few pages is to give you some guidelines and suggestions on using your *Code* book to help you understand that standard, and assist you in what you're trying to accomplish and, ultimately, your personal success as an electrical professional!

Language Considerations for the *NEC*

Terms and Concepts

The *NEC* contains many technical terms, and it's crucial for *Code* users to understand their meanings and applications. If you don't understand a term used in a rule, it will be impossible to properly apply the *NEC* requirement. Article 100 defines those that are used generally in two or more articles throughout the *Code*; for example, the term "Dwelling Unit" is found in many articles. If you don't know the *NEC* definition for a "dwelling unit" you can't properly identify its *Code* requirements. Another example worth mentioning is the term "Outlet." For many people it has always meant a receptacle—not so in the *NEC*!

Article 100 contains the definitions of terms used throughout the *Code*. Where a definition is unique to a specific article, the article number is indicated at the end of the definition in parenthesis (xxx). For example, the definition of "Pool" is specific to Article 680 and ends with (680) because it applies ONLY to that article. Definitions of standard terms, such as volt, voltage drop, ampere, impedance, and resistance are

not contained in Article 100. If the *NEC* does not define a term, then a dictionary or building code acceptable to the authority having jurisdiction should be consulted.

Small Words, Grammar, and Punctuation

Technical words aren't the only ones that require close attention. Even simple words can make a big difference to the application of a rule. Is there a comma? Does it use "or," "and," "other than," "greater than," or "smaller than"? The word "or" can imply alternate choices for wiring methods. A word like "or" gives us choices while the word "and" can mean an additional requirement must be met.

An example of the important role small words play in the *NEC* is found in 110.26(C)(2), where it says equipment containing overcurrent, switching, "or" control devices that are 1,200A or more "and" over 6 ft wide require a means of egress at each end of the working space. In this section, the word "or" clarifies that equipment containing any of the three types of devices listed must follow this rule. The word "and" clarifies that 110.26(C)(2) only applies if the equipment is both 1,200A or more and over 6 ft wide.

Grammar and punctuation play an important role in establishing the meaning of a rule. The location of a comma can dramatically change the requirement of a rule such as in 250.28(A), where it says a main bonding jumper shall be a wire, bus, screw, or similar suitable conductor. If the comma between “bus” and “screw” was removed, only a “bus screw” could be used. That comma makes a big change in the requirements of the rule.

Slang Terms or Technical Jargon

Trade-related professionals in different areas of the country often use local “slang” terms that aren’t shared by all. This can make it difficult to communicate if it isn’t clear what the meaning of those slang terms are. Use the proper terms by finding out what their definitions and applications are before you use them. For example, the term “pigtail” is often used to describe the short piece of conductor used to connect a device to a splice, but a “pigtail” is also used for a rubberized light socket with pre-terminated conductors. Although the term is the same, the meaning is very different and could cause confusion. The words “splice” and “tap” are examples of terms often interchanged in the field but are two entirely different things! The uniformity and consistency of the terminology used in the *Code*, makes it so everyone says and means the same thing regardless of geographical location.

NEC Style and Layout

It’s important to understand the structure and writing style of the *Code* if you want to use it effectively. The *National Electrical Code* is organized using twelve major components.

1. Table of Contents
2. Chapters—Chapters 1 through 9 (major categories)
3. Articles—Chapter subdivisions that cover specific subjects
4. Parts—Divisions used to organize article subject matter
5. Sections—Divisions used to further organize article subject matter
6. Tables and Figures—Represent the mandatory requirements of a rule
7. Exceptions—Alternatives to the main *Code* rule
8. Informational Notes—Explanatory material for a specific rule (not a requirement)
9. Tables—Applicable as referenced in the *NEC*
10. Annexes—Additional explanatory information such as tables and references (not a requirement)
11. Index
12. Changes to the *Code* from the previous edition

1. Table of Contents. The Table of Contents displays the layout of the chapters, articles, and parts as well as the page numbers. It’s an excellent resource and should be referred to periodically to observe the interrelationship of the various *NEC* components. When attempting to locate the rules for a specific situation, knowledgeable *Code* users often go first to the Table of Contents to quickly find the specific *NEC* rule that applies.

2. Chapters. There are nine chapters, each of which is divided into articles. The articles fall into one of four groupings: General Requirements (Chapters 1 through 4), Specific Requirements (Chapters 5 through 7), Communications Systems (Chapter 8), and Tables (Chapter 9).

- Chapter 1—General
- Chapter 2—Wiring and Protection
- Chapter 3—Wiring Methods and Materials
- Chapter 4—Equipment for General Use
- Chapter 5—Special Occupancies
- Chapter 6—Special Equipment
- Chapter 7—Special Conditions
- Chapter 8—Communications Systems (Telephone, Data, Satellite, Cable TV, and Broadband)
- Chapter 9—Tables—Conductor and Raceway Specifications

3. Articles. The *NEC* contains approximately 160 articles, each of which covers a specific subject. It begins with Article 90, the introduction to the *Code* which contains the purpose of the *NEC*, what is covered and isn’t covered, along with how the *Code* is arranged. It also gives information on enforcement, how mandatory and permissive rules are written, and how explanatory material is included. Article 90 also includes information on formal interpretations, examination of equipment for safety, wiring planning, and information about formatting units of measurement. Here are some other examples of articles you’ll find in the *NEC*:

- Article 110—General Requirements for Electrical Installations
- Article 250—Grounding and Bonding
- Article 300—General Requirements for Wiring Methods and Materials
- Article 430—Motors, Motor Circuits, and Motor Controllers
- Article 500—Hazardous (Classified) Locations
- Article 680—Swimming Pools, Fountains, and Similar Installations
- Article 725—Class 2 and Class 3 Power-Limited Circuits
- Article 800—General Requirements for Communications Systems

4. Parts. Larger articles are subdivided into parts. Because the parts of a *Code* article aren't included in the section numbers, we tend to forget to what "part" an *NEC* rule is relating. For example, Table 110.34(A) contains working space clearances for electrical equipment. If we aren't careful, we might think this table applies to all electrical installations, but Table 110.34(A) is in Part III, which only contains requirements for "Over 1,000 Volts, Nominal" installations. The rules for working clearances for electrical equipment for systems 1,000V, nominal, or less are contained in Table 110.26(A)(1), which is in Part II—1,000 Volts, Nominal, or Less.

5. Sections. Each *NEC* rule is called a "*Code* Section." A *Code* section may be broken down into subdivisions; first level subdivision will be in parentheses like (A), (B),..., the next will be second level subdivisions in parentheses like (1), (2),..., and third level subdivisions in lowercase letters such as (a), (b), and so on.

For example, the rule requiring all receptacles in a dwelling unit bathroom to be GFCI protected is contained in Section 210.8(A)(1) which is in Chapter 2, Article 210, Section 8, first level subdivision (A), and second level subdivision (1).

Note: According to the *NEC Style Manual*, first and second level subdivisions are required to have titles. A title for a third level subdivision is permitted but not required.

Many in the industry incorrectly use the term "Article" when referring to a *Code* section. For example, they say "Article 210.8," when they should say "Section 210.8." Section numbers in this textbook are shown without the word "Section," unless they're at the beginning of a sentence. For example, Section 210.8(A) is shown as simply 210.8(A).

6. Tables and Figures. Many *NEC* requirements are contained within tables, which are lists of *Code* rules placed in a systematic arrangement. The titles of the tables are extremely important; you must read them carefully in order to understand the contents, applications, and limitations of each one. Notes are often provided in or below a table; be sure to read them as well since they're also part of the requirement. For example, Note 1 for Table 300.5(A) explains how to measure the cover when burying cables and raceways and Note 5 explains what to do if solid rock is encountered.

7. Exceptions. Exceptions are *NEC* requirements or permissions that provide an alternative method to a specific rule. There are two types of exceptions—mandatory and permissive. When a rule has several exceptions, those exceptions with mandatory requirements are listed before the permissive exceptions.

Mandatory Exceptions. A mandatory exception uses the words "shall" or "shall not." The word "shall" in an exception means that if you're using the exception, you're required to do it in a specific way. The phrase "shall not" means it isn't permitted.

Permissive Exceptions. A permissive exception uses words such as "shall be permitted," which means it's acceptable (but not mandatory) to do it in this way.

8. Informational Notes. An Informational Note contains explanatory material intended to clarify a rule or give assistance, but it isn't a *Code* requirement.

9. Tables. Chapter 9 consists of tables applicable as referenced in the *NEC*. They're used to calculate raceway sizing, conductor fill, the radius of raceway bends, and conductor voltage drop.

10. Informative Annexes. Annexes aren't a part of the *Code* requirements and are included for informational purposes only.

- Annex A. Product Safety Standards
- Annex B. Application Information for Ampacity Calculation
- Annex C. Conduit, Tubing, and Cable Tray Fill Tables for Conductors and Fixture Wires of the Same Size
- Annex D. Examples
- Annex E. Types of Construction
- Annex F. Availability and Reliability for Critical Operations Power Systems (COPS), and Development and Implementation of Functional Performance Tests (FPTs) for Critical Operations Power Systems
- Annex G. Supervisory Control and Data Acquisition (SCADA)
- Annex H. Administration and Enforcement
- Annex I. Recommended Tightening Torque Tables from UL Standard 486A-486B
- Annex J. ADA Standards for Accessible Design
- Annex K. Use of Medical Electrical Equipment in Dwellings and Residential Board-and-Care Occupancies

11. Index. The Index at the back of the *NEC* is helpful in locating a specific rule using pertinent keywords to assist in your search.

12. Changes to the *Code*. Changes in the *NEC* are indicated as follows:

- ▶ Rules that were changed since the previous edition are identified by shading the revised text.
- ▶ New rules aren't shaded like a change, instead they have a shaded "N" in the margin to the left of the section number.
- ▶ Relocated rules are treated like new rules with a shaded "N" in the left margin by the section number.

- ▶ Deleted rules are indicated by a bullet symbol “•” located in the left margin where the rule was in the previous edition. Unlike older editions the bullet symbol is only used where one or more complete paragraphs have been deleted.
- ▶ A “Δ” represents partial text deletions and or figure/table revisions somewhere in the text. There’s no specific indication of which word, group of words, or a sentence was deleted.

How to Locate a Specific Requirement

How to go about finding what you’re looking for in the *Code* book depends, to some degree, on your experience with the *NEC*. Experts typically know the requirements so well that they just go to the correct rule. Very experienced people might only need the Table of Contents to locate the requirement for which they’re looking. On the other hand, average users should use all the tools at their disposal, including the Table of Contents, the Index, and the search feature on electronic versions of the *Code* book.

Let’s work through a simple example: What *NEC* rule specifies the maximum number of disconnects permitted for a service?

Using the Table of Contents. If you’re an experienced *Code* user, you might use the Table of Contents. You’ll know Article 230 applies to “Services,” and because this article is so large, it’s divided up into multiple parts (eight parts to be exact). With this knowledge, you can quickly go to the Table of Contents and see it lists the Service Equipment Disconnecting Means requirements in Part VI.

Author’s Comment:

- ▶ The number “70” precedes all page numbers in this standard because the *NEC* is NFPA Standard Number 70.

Using the Index. If you use the Index (which lists subjects in alphabetical order) to look up the term “service disconnect,” you’ll see there’s no listing. If you try “disconnecting means,” then “services,” you’ll find that the Index indicates the rule is in Article 230, Part VI. Because the *NEC* doesn’t give a page number in the Index, you’ll need to use the Table of Contents to find it, or flip through the *Code* book to Article 230, then continue to flip through pages until you find Part VI.

Many people complain that the *NEC* only confuses them by taking them in circles. Once you gain experience in using the *Code* and deepen your understanding of words, terms, principles, and practices, you’ll find it much easier to understand and use than you originally thought.

With enough exposure in the use of the *NEC*, you’ll discover that some words and terms are often specific to certain articles. The word “solar” for example will immediately send experienced *Code* book users to Article 690—Solar Photovoltaic (PV) Systems. The word “marina” suggests what you seek might be in Article 555. There are times when a main article will send you to a specific requirement in another one in which compliance is required in which case it will say (for example), “in accordance with 230.xx.” Don’t think of these situations as a “circle,” but rather a map directing you to exactly where you need to be.

Customizing Your *Code* Book

One way to increase your comfort level with your *Code* book is to customize it to meet your needs. You can do this by highlighting and underlining important *NEC* requirements. Preprinted adhesive tabs are also an excellent aid to quickly find important articles and sections that are regularly referenced. However, understand that if you’re using your *Code* book to prepare to take an exam, some exam centers don’t allow markings of any type. For more information about tabs for your *Code* book, visit MikeHolt.com/Tabs.

Highlighting. As you read through or find answers to your questions, be sure you highlight those requirements in the *NEC* that are the most important or relevant to you. Use one color, like yellow, for general interest and a different one for important requirements you want to find quickly. Be sure to highlight terms in the Index and the Table of Contents as you use them.

Underlining. Underline or circle key words and phrases in the *Code* with a red or blue pen (not a lead pencil) using a short ruler or other straightedge to keep lines straight and neat. This is a very handy way to make important requirements stand out. A short ruler or other straightedge also comes in handy for locating the correct information in a table.

Interpretations

Industry professionals often enjoy the challenge of discussing, and at times debating, the *Code* requirements. These types of discussions are important to the process of better understanding the *NEC* requirements and applications. However, if you decide you’re going to participate in one of these discussions, don’t spout out what you think without having the actual *Code* book in your hand. The professional way of discussing a requirement is by referring to a specific section rather than talking in vague generalities. This will help everyone

involved clearly understand the point and become better educated. In fact, you may become so well educated about the *NEC* that you might even decide to participate in the change process and help to make it even better!

Become Involved in the *NEC* Process

The actual process of changing the *Code* takes about two years and involves hundreds of individuals trying to make the *NEC* as current and accurate as possible. As you advance in your studies and understanding of the *Code*, you might begin to find it very interesting, enjoy it more, and realize that you can also be a part of the process. Rather than sitting back and allowing others to take the lead, you can participate by making proposals and being a part of its development. For the 2023 cycle, there were over 4,000 Public Inputs and 1,956 Public Comments. This resulted in several new articles and a wide array of revised rules to keep the *NEC* up to date with new technologies and pave the way to a safer and more efficient electrical future.

Here's how the process works:

STEP 1—Public Input Stage

Public Input. The revision cycle begins with the acceptance of Public Input (PI) which is the public notice asking for anyone interested to submit input on an existing standard or a committee-approved new draft standard. Following the closing date, the committee conducts a First Draft Meeting to respond to all Public Inputs.

First Draft Meeting. At the First Draft (FD) Meeting, the Technical Committee considers and provides a response to all Public Input. The Technical Committee may use the input to develop First Revisions to the standard. The First Draft documents consist of the initial meeting consensus of the committee by simple majority. However, the final position of the Technical Committee must be established by a ballot which follows.

Committee Ballot on First Draft. The First Draft developed at the First Draft Meeting is balloted. In order to appear in the First Draft, a revision must be approved by at least two-thirds of the Technical Committee.

First Draft Report Posted. First revisions which pass ballot are ultimately compiled and published as the First Draft Report on the document's NFPA web page. This report serves as documentation for the Input Stage and is published for review and comment. The public may review the First Draft Report to determine whether to submit Public Comments on the First Draft.

STEP 2—Public Comment Stage

Public Comment. Once the First Draft Report becomes available, there's a Public Comment period during which anyone can submit a Public Comment on the First Draft. After the Public Comment closing date, the Technical Committee conducts/holds their Second Draft Meeting.

Second Draft Meeting. After the Public Comment closing date, if Public Comments are received or the committee has additional proposed revisions, a Second Draft Meeting is held. At the Second Draft Meeting, the Technical Committee reviews the First Draft and may make additional revisions to the draft Standard. All Public Comments are considered, and the Technical Committee provides an action and response to each Public Comment. These actions result in the Second Draft.

Committee Ballot on Second Draft. The Second Revisions developed at the Second Draft Meeting are balloted. To appear in the Second Draft, a revision must be approved by at least two-thirds of the Technical Committee.

Second Draft Report Posted. Second Revisions which pass ballot are ultimately compiled and published as the Second Draft Report on the document's NFPA website. This report serves as documentation of the Comment Stage and is published for public review.

Once published, the public can review the Second Draft Report to decide whether to submit a Notice of Intent to Make a Motion (NITMAM) for further consideration.

STEP 3—NFPA Technical Meeting (Tech Session)

Following completion of the Public Input and Public Comment stages, there's further opportunity for debate and discussion of issues through the NFPA Technical Meeting that takes place at the NFPA Conference & Expo®. These motions are attempts to change the resulting final Standard from the committee's recommendations published as the Second Draft.

STEP 4—Council Appeals and Issuance of Standard

Issuance of Standards. When the Standards Council convenes to issue an NFPA standard, it also hears any related appeals. Appeals are an important part of assuring that all NFPA rules have been followed and that due process and fairness have continued throughout the standards development process. The Standards Council considers appeals based on the written record and by conducting live hearings during which all interested parties can participate. Appeals are decided on the entire record of the process, as well as all submissions and statements presented.

After deciding all appeals related to a standard, the Standards Council, if appropriate, proceeds to issue the Standard as an official NFPA Standard. The decision of the Standards Council is final subject only to limited review by the NFPA Board of Directors. The new NFPA standard becomes effective twenty days following the Standards Council's action of issuance.

Temporary Interim Amendment—(TIA)

Sometimes, a change to the *NEC* is of an emergency nature. Perhaps an editing mistake was made that can affect an electrical installation to the extent it may create a hazard. Maybe an occurrence in the field created a condition that needs to be addressed immediately and can't wait for the normal *Code* cycle and next edition of the standard. When these circumstances warrant it, a TIA or "Temporary Interim Amendment" can be submitted for consideration.

The NFPA defines a TIA as, "tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a Public Input of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process."

Author's Comment:

- Proposals, comments, and TIAs can be submitted for consideration online at the NFPA website, www.nfpa.org. From the homepage, look for "Codes & Standards," then find "Standards Development," and click on "How the Process Works." If you'd like to see something changed in the *Code*, you're encouraged to participate in the process.