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PREFACE

The *Electrical Exam Master Guide* was written for electricians by electricians with generations of hands-on technical experience in the electrical business. We created this guide to simplify the electrician's studying regimen. There are a variety of 2 to 4 year programs that prolong the process of passing the Electrical Exam by including other topics that do not pertain to the exam. After taking and passing the exam, we realized time was wasted on topics that did not relate and as a result were not on the exam. That is why we have created a shortcut for those who want to get directly to the point and ace their exam.

The *Electrical Exam Master Guide* focuses on *Code* book navigation, not only *Code* book memorization. The NEC Code book is the nucleus of the Electrical Exam. The main book of the *Electrical Exam Master Guide* follows the same theme of the *NEC Code* book so that you may become familiar with the characteristics and the writing styles of the *NEC Code* book. We dissect the most essential chapters for electricians to understand because the *NEC Code* book also pertains to engineers, manufacturers, power companies and others in the electrical field.

From the beginning to the end, the *Electrical Exam Master Guide* will take you through the vital components that will support you in the process in passing your exam.

As we stand behind our 90-day study techniques, we are certain that if you apply yourself, you can definitely pass and ace your exam on the first try. This is a major step in moving forward with your career. Obtaining your license can start you on a path to having your business and opening more doors in the electrical field.

The questions of this book were written in a keyword technique (KWT) approach. When you become familiar with the KWT, it will help you identify the key terms of the questions asked on the electrical exam. Once you identify these key terms, the next step will be to quickly locate them in the *NEC Code* section. This will reduce your research time by 50% - 75% and answer questions more efficiently.

If your are looking for a straight to the point guide that will lead you to your end goal, this is the complete guide. Here's to your success!

INTRODUCTION

As the *Electrical Exam Master Guide*, we have selected key information found within the *National Electrical Code (NEC)*. We will start with Article **90** which covers the purpose of this *Code*.

Section **90.1** states that the purpose of this *Code* is the safeguarding of people and property from the dangers of electricity. Being that this *Code* is a national standard, it covers many topics listed in Section **90.2 (A)**. You may also take note of what the code does not cover in Section **90.2(B)**.

Special permission may be granted by the **Authority Having Jurisdiction**. The **AHJ** has the power to interpret the rules of the *Code* and determine the approval of the materials and equipment that may need the granting of special permission.

- 📍 **90.5(A)** Mandatory rules pinpoint the actions that are required or prohibited with the commonly used terms “shall” or “shall not.”
- 📍 **90.5(B)** Permissive rules identify the actions that are permitted but are not necessary with the frequently used terms “shall be permitted” or “shall not be required.”
- 📍 **90.5(C)** Explanatory material further describes *Code* sections and it is used as a source of reference, such as the Informational Notes.

The internal wiring need not be inspected as long as the construction material or equipment is a listed product (90.7). This *Code* allows for future plans or expansions by providing additional space for future increases of electrical power (90.8(A)).

Key Note

90.3 Code Arrangement

This *Code* is divided into the introduction and nine chapters,

Chapter 1 — General

Chapter 2 — Wiring and Protection

Chapter 3 — Wiring Methods & Materials

Chapter 4 — Equipment for General Use

Chapter 5 — Special Occupancies

Chapter 6 — Special Equipment

Chapter 7 — Special Conditions

Chapter 8 — Communications Systems

Chapter 9 — Tables

Annex A through Annex H

Key Note

Fine print notes have been renamed as **Informational Notes** to clarify that they are informational only and are not enforceable as requirements of this *Code*. They present additional supplementary information for the code section that they follow.

The number of circuits in enclosures will be listed in charts throughout this *Code*. They will have a variety of restrictions including the number of wires in an enclosure, ampacity and temperature rating. This is in place to limit the amount of short circuits and ground faults in one circuit (90.8(B)).

Covered in this *Code* are:

- Public & private premises
- Buildings
- Structures
- Mobile Homes
- Recreation vehicles
- Floating buildings
- Yards
- Parking lots
- Carnivals
- Industrial sub-stations
- ...just to name a few

Not covered in this *Code* are:

- Ships
- Watercrafts other than floating buildings
- Aircrafts
- Automotive vehicles other than mobile homes
- Underground mines
- Railways
- ...among others

Now that you have read the summary for Section 90, refer to your NEC Code Book to answer the following questions. Note that the answers will only be found in Section 90.

To help you begin to identify keywords on your own, we have highlighted a few keywords in bold. When you read the question, identify the most important words to quickly locate them in the code book. With time, you will notice the keywords more quickly and relate them to the appropriate section of the *Code*.

ARTICLE 90 QUIZ

Note that the answers will only be found in Article 90

- 1) What is the **intention** of the *Code* book?
 - A. It is a how-to manual
 - B. It is an instruction manual for untrained persons
 - C. Safeguarding from hazards from the use of electricity
 - D. Safeguarding circuits

- 2) This *Code* covers?
 - A. Ships
 - B. Equipment
 - C. Automotive
 - D. Aircraft

- 3) What three Chapters are used for **Special Use**?
 - A. 5, 6, and 7
 - B. 9, 8, and 7
 - C. 6, 7, and 8
 - D. 2, 3, and 4

- 4) Limiting the number of circuits in a **single enclosure** _____ the effects from a **short circuit** or **ground fault** in one circuit.
 - A. Magnifies
 - B. Minimizes
 - C. Naturalizes
 - D. Maximizes

- 5) Which **governing body** regulates the formal interpretation of the National Electrical Code?
 - A. City Inspector
 - B. Chief Inspector
 - C. NFPA
 - D. Permit Office

- 6) Why do **hazards** occur?
- A. Loose wiring
 - B. From the temperature outside
 - C. Untrained helpers
 - D. Overloading of wiring systems
- 7) This *Code* does not cover?
- A. Mobile homes
 - B. Parking lots
 - C. Recreational vehicles
 - D. Floating buildings
- 8) **Special Permission** may be granted by
- A. Power company
 - B. Property owner
 - C. Authority Having Jurisdiction
 - D. Company owner
- 9) When the terms “shall” or “shall not” are used, what does this indicate?
- A. Mandatory rules
 - B. Permissive rules
 - C. Explanatory material
 - D. Standard rules
- 10) In this codebook what is explanatory material?
- A. Fine print note
 - B. Informational notes
 - C. Code standards
 - D. Requirements of the NEC

CHAPTER 1-GENERAL

Article **100** lists definitions that are commonly used in the NEC. Before you can grasp a clear understanding of the *Code* you must be familiar with these terms and definitions. Review the definitions listed at the beginning of each Article in the *Code* book to learn how the terms are used in that Article.

Article **110** discusses the general requirements for installations of electrical conductors and equipment (**110.2**). The (AHJ) shall have the final say on all electrical equipment used in electrical installations. This *Code* will take you through conductor sizes (**110.6**) which are referred to as American Wire Gauge (AWG). Also discussed is listing and labeling (**110.3(B)**) to make sure that equipment is properly installed according to their instructions.

The discussion on voltages (**110.4**) explains that equipment shall operate at the voltage required. Always read the nameplate and instructions to ensure you have the proper voltage.

Wiring integrity is of the utmost importance in the NEC. All installations shall be free of short circuits and ground faults (**110.7**). This *Code* provides the acceptable wiring methods (**110.8**) for any building or occupancy in which electricity shall be installed. Electrical connections (**110.14**) shall be properly installed with the use of the similar material. For example, copper conductors shall be landed on copper terminals. Conductors of dissimilar metals shall not intermixed unless listed for intermixing.

The identification of disconnecting means is critical. Always ensure that the disconnecting means are legibly and permanently marked and the locations of the disconnecting means are evident (**110.22**).

Key Note

110.5 Conductors

Unless otherwise noted, current-carrying conductors are copper and the material and sizes given shall apply to copper conductors.

Key Note

110.15 High-Leg Marking

On 4-wire delta systems, the conductor having the higher phase voltage shall be permanently marked orange in color where the connections are made.

Key Note

110.16 Arc-Flash Hazard Warning

Electrical equipment that will need examination while energized shall be field marked to warn qualified persons of potential Arc Flash.

Key Note

110.24 Available Fault Current

Service equipment in other than dwelling shall be marked with the Maximum available fault current.

The workspace around electrical equipment is discussed from Sections **110.26-110.36**. It begins with 600 volts, nominal or less to over 600 volts and the workspace clearance for both are different. Therefore, the voltages must be known to allow the proper workspace. The voltages are not from phase to phase but rather from phase to ground. Take a look at the table illustrated in Section **110.26(A)(1)**. This chart will give you the three conditions and the required amount of feet of working space for each one. While reading this section you will notice the different workspace variations between depth, width, height and clearances.

The *Code* lists variations extending from the grade floor or platform for height requirements (**110.26(A)(3)**) and for headroom (**110.26(E)**). The minimum requirement for headroom is 6 ½ feet or not less than the height of the equipment.

Most conductors and equipment follow Part 1 of this section. Part 3 of this section relates to voltage exceeding 600 volts, nominal. Some modifications are made when dealing with voltages above 600. As the voltage increases, so do the requirements for workspace (**110.34(A)**). A point to note is the separation of low voltage equipment. Other safety measures have been taken as you will find most equipment in locked rooms or enclosures (**110.34(C)**).

For the protection of equipment and gear, foreign pipes and ducts that may endanger the operation of the electrical system shall not be located in the vicinity of electrical equipment (**110.34(F)**).

Tunnel installations over 600 volts, nominal, shall apply to high-voltage power distributions. This section shall be additional to *Code* Sections **100-490**. This section explains the requirements for protection against physical damage, overcurrent protection, grounding and bonding and disconnect means (**110.51-110.59**).

Manholes and other electrical enclosures intended for personnel entry shall be a sufficient size to allow safe work (**110.70**). Workspace shall be a minimum of 3 feet wide with vertical headroom of 6 feet. This section also includes conductors installation (**110.74**) and access to manholes (**110.75**).

Key Note

110.26(A)(2) Width of Working Space
The width of the working space in front of the electrical equipment shall be a minimum of 30 inches or the width of the equipment, whichever is greater.

Key Note

110.34(C) Locked Rooms or Enclosures
Where voltage exceeds 600 volts, nominal, permanent warning signs shall read:
“DANGER-HIGH VOLTAGE-KEEP OUT”

Key Note

110.75 Access to Manholes
26 in. X 22 in. round access openings