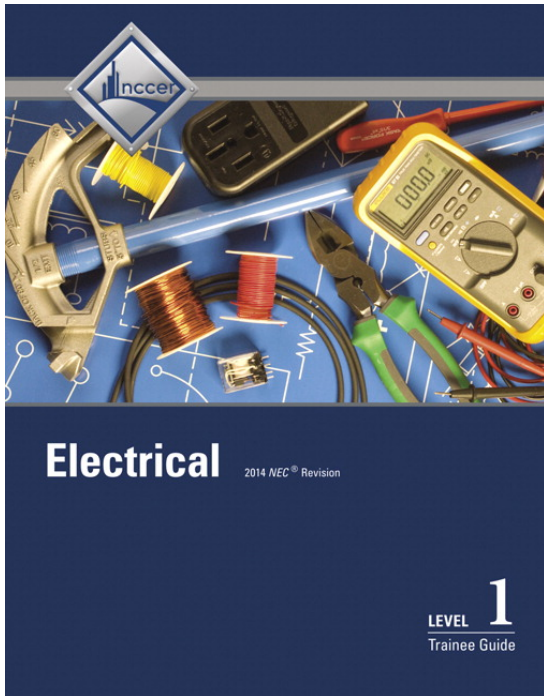
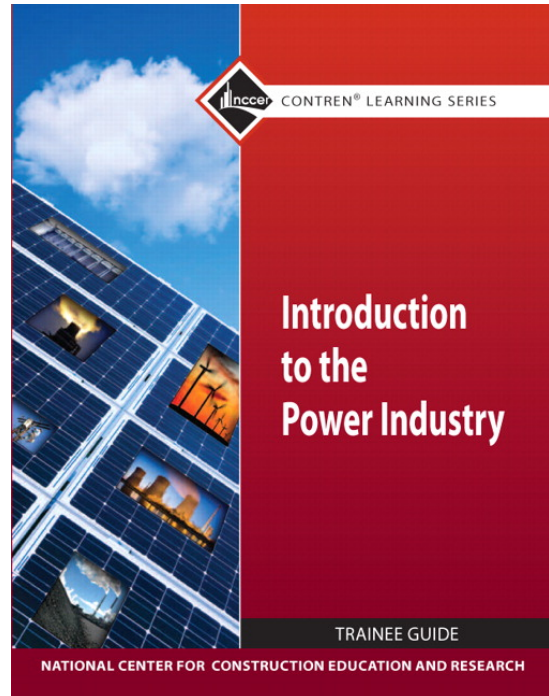


# A Correlation and Narrative Brief of Tennessee Electrical Systems



**Electrical**



**Introduction to the  
Power Industry**

## To the Tennessee Architecture and Construction Course Standards for Electrical Systems

## **TEXTBOOK NARRATIVE FOR THE STATE OF TENNESSEE**

### **Tennessee Electrical Systems Student Edition Package ISBN 978-0-13-456133-2**

#### **HIGHLIGHTS:**

- NCCERconnect – eLearning Series is a new and improved online supplement in XL platform. This unique online course supplement in the form of an electronic book and essential course management tools is delivered through an exceptional user-friendly interface, [www.nccerconnect.com](http://www.nccerconnect.com). NCCERconnect provides a range of visual, auditory, and interactive elements to enhance student learning and instructor delivery of craft training.
- The realistic ebook experience consists of the actual print book and integrated tools such as highlighting, notes, zoom, bookmarks, search capability, and more! The etext contains links to active figures.
- Prebuilt homework assignments enable students to work at any time, and they incorporate a scores report to gradebook. Homework assignments contain module reading, concept checks, and drag-and-drop Trade Term questions.
- Quiz assignments contain Review Questions in multiple choice, and they incorporate scores report back to gradebook.
- Multimedia library is searchable by modules and contains PPTs and resources.
- Student Support Page includes a written learning pathway for students so they know what is found within the course and how to use the resource. The page also includes technical support resources.

#### **NEW TO THIS EDITION:**

- *Electrical Level 1* has been updated to meet the 2014 *National Electrical Code*®.
- The text includes revisions to the module examinations.
- To provide a comprehensive, user-friendly resource, the text incorporates various features to provide students with the proper tools to get started in the electrical industry. These features include:
  - Learning objectives at beginning of each module
  - Color illustrations and photographs
  - On Site features present technical tips and professional practices from master electricians in various disciplines
  - Safety, Going Green, and Case History features
  - Step-by-step instructions guide students through technical procedures and tasks
  - Each module presents a list of Trade Terms that are discussed within the text and defined at the end of each module
- The *Introduction to the Power Industry* module sets the stage for trainees entering the electrical energy production and distribution field. It describes the many ways in which electricity can be produced, from burning fuels to harnessing nuclear energy, and using renewable energy resources.

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**SUPPLEMENTS:**

The NCCERconnect Instructor access card, ISBN 9780134261485, provides free access to all NCCER courses in [www.nccerconnect.com](http://www.nccerconnect.com). NCCERConnect provides all the standard XL instructor tools:

- Course Home Manager
- Assignment Manager
- Gradebook displays students' results of Concept Checks, Review Questions, and any additional quizzes/tests added to your course.
- Roster/Course Details
- Course Settings
- Multimedia Library
- Instructor Toolkit provides easy access to lesson plans and lecture slide presentations.
- Customization of your course is easy and allows for maximum flexibility. Move existing folders or create new ones. Add/upload your own content or create additional tests/quizzes. It's all here!
- Instructor Support Page includes a written summary of what is found within the course. The page also includes technical support resources.

The annotated instructor's guide, ISBN 978-0-13-383004-0 and 978-0-13-215414-7, contains an access code to the NCCER Instructor Resource Center. The NCCER Instructor Resource Center contains the following digital resources:

- Lesson Plans
- Module PowerPoints
- Performance Profile Sheet

TestGen (Exam Questions)

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<b>Tennessee Course Standards for Electrical Systems</b>	<b>Tennessee Electrical Systems</b>
<b>Electrical Systems</b>	
<b>Course Standards</b>	
<b>Safety</b>	
<p>1) Identify safety hazards on a jobsite and demonstrate practices for safe working. Accurately read, interpret, and demonstrate safety rules, including but not limited to rules pertaining to electrical safety, Occupational Safety and Health Administration (OSHA) guidelines, and state and national code requirements. Be able to distinguish between the rules and explain why certain rules apply. Recognize and employ universal construction signs and symbols such as colors, flags, stakes, and hand signals that apply to construction workplace situations. Research and evaluate construction company safety plans from local industry. Explain the need for jobsite security to prevent liability. Drawing from examples, create and implement a jobsite safety program in the class to ensure safe practices and procedures including jobsite security procedures. (TN Reading 3, 4, 6; TN Writing 2, 4; NCCER 26102-14)</p>	<p><b>Electrical Level 1, SE/TE: 2.1-40</b></p>
<p>2) Continue to maintain safety records and demonstrate adherence to industry-standard practices regarding general machine safety, tool safety, equipment safety, electrical safety, and fire safety to protect all personnel and equipment. For example, when operating tools and equipment, regularly inspect and carefully employ the appropriate personal protective equipment (PPE), as recommended by Occupational, Safety &amp; Health Administration (OSHA) regulations. Incorporate safety procedures when operating tools and equipment, such as hand and power tools, ladders, scaffolding, and lifting equipment. Complete safety test with 100 percent accuracy. (TN Reading 3, 4; NCCER 26102-14)</p>	<p><b>Electrical Level 1, SE/TE: 2.6-9, 2.10-17, 2.18-22, 2.22-26, 2.27-31, 2.31-36</b></p>

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<b>Tennessee Course Standards for Electrical Systems</b>	<b>Tennessee Electrical Systems</b>
3) Follow procedures to work safely around materials. Adhere to responsibilities for employees in material safety as outlined by the Hazard Communication Standard (HazCom), such as locating and interpreting material safety data sheets (MSDS). For example, obtain an MSDS for a given material from a supplier in the community. Demonstrate safe procedures to move materials by planning the movement, properly lifting, stacking, and storing materials, and selecting proper materials-handling equipment. (TN Reading 3, 4; NCCER 26102-14)	<b>Electrical Level 1, SE/TE:</b> 2.22-26, 2.27-31
4) Describe hazards involved when working with electricity and determine procedures to safeguard against them in the workplace, including ensuring power load balance, adhering to the appropriate use of ground-fault circuit interrupters (GFCIs) when working with power tools, and performing lockout/tagout procedures. (TN Reading 3, 4; NCCER 26102-14)	<b>Electrical Level 1, SE/TE:</b> 2.2-4, 2.9-10, 2.26, 2.39, 2.42
<b>Tools &amp; Equipment</b>	
5) Identify and select the proper tools and accessories, critique the readiness of the tools, use the tools to accomplish the desired tasks, and then return the tools and accessories to their proper storage. Research a new technology recently developed for the electrical industry. Write persuasively to convince an employer how the use of the technology could benefit the company, citing evidence from resources. For example, describe how a new power tool could improve efficiency for a technician. (TN Reading 2, 3, 4; TN Writing 1, 9)	<b>Prerequisite Course: Fundamentals of Construction 00103-15 Introduction to Hand Tools SE/TE:</b> M3.8-9

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6) Distinguish among the various types and uses of electrical test equipment. Determine the appropriate test equipment for a given situation and environment and the procedures necessary for safe use. Utilizing test equipment such as a voltmeter, inspect and test an electrical wiring system for compliance according to drawings, specifications, and code requirements. (TN Reading 3, 4, 6; TN Math N-Q; TN Physical Science 2; TN Physics 5: NCCER 26112-14)	<b>Electrical Level 1, SE/TE:</b> 12.1-14
<b>Construction Industry Principles</b>	
7) Locate and assess requirements for performing electrical work including local, state, and national requirements. Interpret electrical codes, and determine inspection procedures and other applicable portions of the law. Visit the Tennessee Contractor's Licensing Board's website and analyze its policies and requirements. Explain how such policies impact local construction businesses. (TN Reading 2, 3, 4, 9; TN Writing 7, 8; NCCER 26105-14)	<b>Electrical Level 1, SE/TE:</b> 5.1-13, 5.16-17
8) Consult a variety of sources to describe alternatives to traditional project delivery methods, such as the design-build and construction management-related methods, distinguishing among the roles and relationships of various construction personnel in each scenario. Examine the project delivery method of an actual company. Develop a company profile with supporting graphics the company could share with a client, describing the services provided and explaining the project delivery method used by the company. (TN Reading 2, 3, 4, 5, 7, 8; TN Writing 2, 4; NCCER 44105-08)	<p><b>Prerequisite Course: Covered in Fundamentals to Construction- Project Management 44105-08 Construction Documents:</b> 5.2-24</p> <p><b>Prerequisite Course: Covered in Fundamentals to Construction- Project Management 44101-08 Introduction to Project Management:</b> 1.12-13</p>

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<b>Tennessee Course Standards for Electrical Systems</b>	<b>Tennessee Electrical Systems</b>
<b>National Electrical Code (NEC<sup>®</sup>)</b>	
<p>9) Describe the purpose and layout of the National Electrical Code (NEC<sup>®</sup>). Create a chart to illustrate what is and is not covered by the NEC<sup>®</sup>, citing evidence from <i>NEC<sup>®</sup> Article 90</i>. Navigate, read, and interpret the NEC<sup>®</sup> to determine requirements for a given electrical installation. For example, interpret the NEC<sup>®</sup> to compare and contrast the box requirements for a device box to support a wall receptacle with those for a box to support a lighting fixture. (TN Reading 1, 2, 4, 6, 7, 9; TN Writing 2, 9; NCCER 26105-14)</p>	<b>Electrical Level 1, SE/TE: 5.1-13, 5.16-1</b>
<b>Device Boxes</b>	
<p>10) Distinguish among the various types of device boxes, such as metallic and nonmetallic device boxes. For a variety of given residential and/or commercial applications, select appropriate device boxes according to drawings, specifications, and code requirements. Steps should include identifying the proper box type and size; and determining the minimum size pull or junction box for conduit entering and exiting (both for a straight pull and at an angle). (TN Reading 3, 4, 6, 9; NCCER 26106-14)</p>	<b>Electrical Level 1, SE/TE: 6.1-17, 6.18-20</b>
<p>11) Utilize the proper tools, equipment, and procedures to safely perform installation of a variety of device boxes according to drawings, specifications, and code requirements. (TN Reading 2, 3, 4; NCCER 26106-14)</p>	<b>Electrical Level 1, SE/TE: 6.12-16</b>

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<b>Tennessee Course Standards for Electrical Systems</b>	<b>Tennessee Electrical Systems</b>
<b>Hand Bending</b>	
12) Describe the procedures, techniques, and tools for hand bending and installing conduit. Implement geometric principles to plan and use a hand bender to make 90 degree bends, back-to-back bends, offsets, kicks, and saddle bends. For example, use trigonometric ratios of right triangles to determine the offset angle of an offset bend and use the calculation to accurately create the bend. (TN Reading 3, 4; TN Math N-Q, G-RST; NCCER 26107-14)	<b>Electrical Level 1, SE/TE: 7.1-17</b>
13) Apply the appropriate tools, equipment, and procedures to safely cut, ream, and thread conduit. For example, ream the inside edge of a piece of conduit using a hand reamer. (TN Reading 3, 4; NCCER 26107-14)	<b>Electrical Level 1, SE/TE: 7.12-17</b>
<b>Raceway Systems</b>	
14) Explain the function of raceway systems, including acting as a grounding conductor. Distinguish among the various types of raceways, fittings, and conduit bodies available for raceway systems. Analyze a given environment and select the appropriate materials and installation methods for a raceway system, citing evidence from textbooks and codes. For example, recommend the appropriate raceway materials and installation method for a wood frame building of given parameters, drawing on evidence from codes such as the National Electrical Code (NEC <sup>®</sup> ). (TN Reading 2, 3, 4, 6, 9; TN Writing 2, 9; NCCER 26108-14)	<b>Electrical Level 1, SE/TE: 8.1-53</b>
15) Outline the methods and procedures used to install various raceway systems, including terminating conduit. Accurately connect conduit to a box according to code requirements, explaining the need for a proper connection based on grounding requirements and protection of the wires. Apply the appropriate tools and procedures to install flexible raceway systems. (TN Reading 2, 3, 4, 6; NCCER 26108-14)	<b>Electrical Level 1, SE/TE: 8.1-8, 8.8-12, 8.12-13, 8.29-30, 8.31-40</b>



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<b>Tennessee Course Standards for Electrical Systems</b>	<b>Tennessee Electrical Systems</b>
<b>Conductors &amp; Cables</b>	
16) Building on knowledge of conductors from <i>Mechanical, Electrical, &amp; Plumbing Systems</i> , read and interpret the NEC <sup>®</sup> and other instructional texts to determine the allowable ampacity of conductors for a variety of given applications. Include the insulation and jacket material, conductor size and type, number of conductors, temperature rating, and voltage rating of each. Describe possible consequences of improper conductor selection or installation, citing evidence from resources such as textbooks or trade journals. (TN Reading 1, 2, 3, 4, 5; NCCER 26109-14)	<b>Electrical Level 1, SE/TE:</b> 9.1-24
17) Describe the proper methods and procedures for installing conductors in a raceway system, noting potential hazards that exist when conductors are installed incorrectly. Employ tools and procedures to safely install conductors in a raceway system and verify the installation is performed according to code requirements. (TN Reading 2, 3, 4, 6; TN Writing 2, 9; NCCER 26109-14)	<b>Electrical Level 1, SE/TE:</b> 9.14-19
<b>Construction Drawings &amp; Specifications</b>	
18) Building on knowledge of construction drawings and specifications from <i>Mechanical, Electrical, &amp; Plumbing Systems</i> , read and interpret electrical drawings and specifications, including detail drawings and equipment schedules, to create a list of materials needed for a given electrical project. For example, analyze a lighting plan, light fixture schedule, and specifications for a residence to determine the materials needed to install the lighting system. (TN Reading 2, 3, 4, 6, 7; TN Writing 2, 9; TN Math N-Q; NCCER 26110-14)	<b>Electrical Level 1, SE/TE:</b> 10.8, 10.14-24, 10.29-40, 10.41-47

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<p>19) Explain the relationship between construction drawings and specifications. For example, describe how both the construction drawings and specifications provide information about the raceway system indicated for a given building. Examine construction drawings and specifications to determine the requirements for a raceway system in a given building. (TN Reading 1, 2, 4, 5, 6, 7; NCCER 26110-14, 44105-08)</p>	<p><b>Electrical Level 1, SE/TE:</b> 10.1, 10.47-62</p>
<p>20) Describe processes by which construction professionals obtain clarification from architects regarding construction documents, such as by the use of requests for information (RFI's). Write a request for information (RFI) as would a construction professional to an architect to request clarification for a detail of the construction documents, such as the selection of a product. (TN Writing 4; NCCER 44105-08)</p>	<p><b>Prerequisite Course: Fundamentals of Construction: Project Management 44105-08</b> <b>Construction Documents:</b> 5.2-27</p>
<b>Residential Electrical Services</b>	
<p>21) Evaluate and recommend proper electrical hardware for a residential building. For example, for a residential dwelling with a given floor plan and schedule of major appliances, determine the size of the electrical service by referring to the National Electrical Code<sup>®</sup> and local code to select the service-entrance equipment, such as conductors, panelboard, and protective devices. Steps should include: calculating the load for lighting, small appliances, and large appliances; and determining the number of branch circuits required. Describe the installation rules pertaining to dedicated circuits as applied to various equipment such as ranges, dryers, and HVAC systems. (TN Reading 2, 3, 4, 7; TN Math N-Q; TN Physical Science 2; NCCER 26111-14)</p>	<p><b>Electrical Level 1, SE/TE:</b> 11.1-66</p>

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<b>Tennessee Course Standards for Electrical Systems</b>	<b>Tennessee Electrical Systems</b>
<b>Basic Maintenance &amp; Repair Process</b>	
22) Identify and demonstrate basic troubleshooting strategies appropriate for evaluating electrical systems and devices. For example, in electrical systems, develop and implement a troubleshooting strategy to test and remedy an electrical fault. (TN Reading 3)	This standard falls outside of the program curriculum.
23) Identify routine maintenance procedures that should be performed on electrical systems for a given building. Create a timeline of recommended maintenance procedures for a client, justifying why each procedure is necessary by highlighting its preventive or cost-efficient characteristics. For example, create a schedule of tests to ensure emergency alarms are operating properly. (TN Reading 2, 3, 4, 7; TN Writing 4)	This standard falls outside of the program curriculum.
<b>Introduction to Power Systems</b>	
24) Analyze typical electric power systems in a region by explaining how electricity is generated, transmitted, and distributed from a power plant to a given location. Describe different types of traditional power generation including fossil-fuel generation and nuclear energy. Explain the basic layout of the power grid and the function of its components, including substations and transformers. (TN Reading 2, 3, 4; TN Environmental Science 5; NCCER 49101-10)	<b>Introduction to the Power Industry SE/TE: Power Generation Maintenance Electrician 49101-10:</b> 1.1-18, 1.22-26
25) Discuss the environmental impacts of generating and distributing electricity. Research alternate electric power systems, including but not limited to photovoltaic systems and wind power technologies. Describe the functions of the systems and analyze their use in regions across the country according to informational texts and technical specs. Compare and contrast at least three types of power generation systems in a written text, chart, or visual display. (TN Reading 2, 3, 4, 7; TN Writing 2, 9; TN Math N-Q; TN Environmental Science 5; NCCER 49101-10)	<b>Introduction to the Power Industry SE/TE: Power Generation Maintenance Electrician 49101-10:</b> 1.12-18

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<b>Tennessee Course Standards for Electrical Systems</b>	<b>Tennessee Electrical Systems</b>
<b>Business &amp; Project Management</b>	
26) Describe the components and purpose of a basic contract document for a residential project, determining the meaning of key terms and other industry-specific words. Recognize the relationship and responsibilities of various parties to a contract. Write a basic contract for a construction job, such as an electrical service agreement for wiring work done for a residential client. (TN Reading 2, 3, 4, 5; NCCER 44105-08)	<b>Prerequisite Course: Fundamentals in Construction: Project Management 44105-08</b> <b>Construction Documents: 5.8-10</b>
27) Establish and implement specific goals to manage project assignments in a timely manner, including organizing teams to effectively manage assignments, monitoring and reporting on project progress, and evaluating a completed project according to client requirements. For example, inspect and critique a team member's work, providing constructive feedback for improvement. Similarly, respond to constructive feedback from a team member to improve project outcomes and meet project goals. (TN Reading 2, 6; TN Writing 2)	This standard falls outside of the program curriculum.
28) Interpret construction drawings and applicable national and local codes to determine the correct materials, tools, and equipment needed to complete a construction project. Plan and implement the steps needed to complete the project, adhering to inspection procedures and employing safe practices throughout. Draw from print and electronic examples to create a material list, cost estimation, project schedule, and inspection checklist for a project, applying the components of the documents to the given project. (TN Reading 2, 3, 9; TN Writing 4)	<b>Prerequisite Course: Fundamentals of Construction 00105-15 Introduction to Construction Drawings SE/TE: M5.2-27, M5.27-31, M5.31-34, M5.36-39, M5.41-42, MP.2-MP.5</b>
29) Produce clear and coherent writing for communication in the electrical industry. Create a service order for a given electrical project. Explain the service order to a peer, as would a service technician to a client. (TN Writing 4)	<b>Prerequisite Course: Fundamentals of Construction 00107-15 Basic Communication Skills SE/TE: M7.16-19</b>

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30) Utilize technology to write and share periodical reports (weekly, monthly, etc.) to provide others with information about progress during electrical projects as would a project manager to a supervisor. Summarize activities in a narrative form including overall progress in relationship to a previously planned schedule. (TN Reading 3; TN Writing 2, 4, 6, 10)	This standard falls outside of the program curriculum.
<b>Portfolio</b>	
31) Update materials from coursework to add to the portfolio started in <i>Fundamentals of Construction and Mechanical, Electrical, &amp; Plumbing Systems</i> . Continually reflect on coursework experiences and revise and refine the career plan generated in prior courses. Include photographs or illustrations and written descriptions of sequential progress in construction projects. (TN Writing 2, 4, 5, 6)	This standard falls outside of the program curriculum.

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