Preface

Welcome to the second edition of *Residential Wiring Concepts and Applications*! This textbook was created to provide a comprehensive overview of the tools, materials, and the *National Electrical Code® (NEC®)* rules and requirements pertaining to residential wiring. Designed for students both new to the study of electricity and those with practical experience, *Residential Wiring Concepts and Applications* provides a firm foundation for the study of residential wiring.

The text is divided into two parts. Part 1 covers basic skills and knowledge, while Part 2 covers hands-on installation and house wiring. The chapters are in an order that fosters learning as each chapter builds upon those that came before. Beginning with the essential tools and materials used in residential wiring and continuing with chapters devoted to the rules and requirements for electrical installations, *Residential Wiring Concepts and Applications* contains chapters covering print reading, residential framing, and service calculations. Also included are chapters covering essential material such as retrofitting, service and repair, and charging circuits for electric automobiles.

Residential Wiring Concepts and Applications contains numerous photographs and illustrations to help students understand the ideas described. In addition, step-by-step examples of the most common calculations required by the *NEC* are also included. This text also provides the contextual background information needed to explain the "why" behind the *NEC* rules. Updated for the 2026 edition of the *NEC* cycle, this textbook contains the most up-to-date information on electrical installations.

The job outlook for residential wiring technicians is strong and growing. Anyone who wishes to make a career in the field of residential wiring can find employment in this field. Upon mastery of the material contained herein, the student will have the knowledge to design, install, and troubleshoot electrical systems in homes of any size.

About the Authors

Quinton B. Phillips was the Program Chair of Electrical Systems Technology and an instructor at Athens Technical College. In 2018, he was selected by faculty and students to receive the Athens Technical College Rick Perkins Award, honoring a technical college instructor who made significant contributions to technical education through innovation and leadership. After graduating from the University of Georgia's Grady College of Journalism in 1988, Mr. Phillips spent time working in the service industry. Looking for a career path and a solid wage, he enrolled in the Electrical Program at Athens Technical College, and it changed the course of his life. Mr. Phillips worked for several years as an apprentice before starting his own company, ZAP! Electric.

Matthew Wilkinson is a licensed Master Electrician with over 25 years of experience in the electrical field, beginning as a construction electrician apprentice and eventually achieving master electrician certification. Mr. Wilkinson transitioned into full-time electrical instruction over a decade ago at Madison Area Technical College where he has been dedicated to training the next generation of electricians as a full-time Construction Electrician Apprenticeship faculty member, Program Director for Electrical Construction, and Department Chair for Construction. As program director, he oversees a one-year technical diploma program in electricity, construction electrician apprenticeship program, and voice data video apprenticeship program.

In addition to an electrical construction background, Mr. Wilkinson completed a bachelor's degree program in Career and Technical Education and Training, as well as a master's degree in Adult Education. He has been very involved in safety-related education and is an authorized OSHA instructor for both general industry and construction and a Certified Electrical Safety Compliance Professional (CESCP). His passion lies in equipping apprentices with the knowledge and skills to succeed in the electrical trade while emphasizing workplace safety and industry best practices.

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Reviewers

The author and publisher wish to thank the following industry and teaching professionals for their valuable input into the development of *Residential Wiring Concepts and Applications*.

Timothy J. Brady
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Schnecksville, PA

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George Thornsbury
Big Sandy Community and Technical College
Pikeville, KY

John G. Veitch
SUNY Adirondack
Queensbury, NY

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Acknowledgments

The author and publisher would like to thank the following companies, organizations, and individuals for their contribution of resource material, images, or other support in the development of *Residential Wiring Concepts and Applications*.

Arlington Industries, Inc.
Carlon, Lamson & Sessions
Eaton
General Tools
Hubbell Incorporated
Ideal Industries, Inc.
Klein Tools
Milwaukee Electric Tool Corporation
Stanley Black & Decker
The Garlinghouse Company
US Department of Energy
Werner Co.

The National Electrical Code®

The most informative and authoritative body of information concerning electrical wiring installation in the United States, and perhaps the world, is the *National Electrical Code (NEC)*. This *code* establishes a set of rules, regulations, and criteria for the installation of electrical equipment. Compliance with these methods will result in safe installation.

The *NEC* is drafted by a team of experts assembled for this purpose by the National Fire Protection Association (NFPA). This team is formally called the *National Electrical Code* committee. They revise and update the *NEC* every three years. It is imperative that anyone installing electrical wiring obtains and studies the *NEC*. Articles and sections of the *NEC* are referred to throughout this text. Although certain portions, tables, and examples are directly quoted from its text, there is enough useful information in the *NEC* that not having it available would be a tremendous hindrance.

The latest edition of the *NEC* can be purchased from the National Fire Protection Association by visiting their website. Online access to the *NEC* and over 1,400 NFPA codes and standards is available with an NFPA LiNK® subscription. NFPA LiNK includes all current editions as well as a library of legacy codes and standards going back five editions. Subscribers also have early access to newly released editions before the printed book is available for purchase. To learn more about NFPA LiNK, visit the NFPA website at www.nfpa.org.

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New to This Edition

The following chapter-level changes have been made to the second edition of *Residential Wiring Concepts and Applications* to expand on essential concepts while reinforcing foundational knowledge.

- New **Chapter 2: Electrical Fundamentals.** This chapter includes some information from Chapter 1 of the first edition, but provides a more in-depth overview of electrical fundamentals, includes new illustrations to further explain essential concepts for success in the electrical field, and has new features that support learning.
- New **Chapter 33: Signaling Devices.** This chapter includes limited information from Chapter 32 of the first edition, providing primarily new content on life safety, door and security, and remote-controlled signaling devices.
- Combined **Chapter 22: Switch Wiring Applications.** This chapter combines Chapters 13 and 14 from the first edition into one location and moves it into a more appropriate section.

The following additions, revisions, and technical updates were also included throughout the text to provide the most up-to-date information.

- Alignment to the 2026 edition of the *NEC*.
- Refined learning outcomes to further align our pedagogy with Learning Design best practices and focus the content into measurable, actionable goals. This includes restructuring some chapters into smaller, digestible chunks and new and updated end-of-chapter questions.
- Over 100 new illustrations and photos throughout the text provide examples of materials and devices in use; to further clarify complex concepts with detailed schematics and blueprints; and to highlight emerging methods, materials, and technology.
- Added Application section question to Code Application features that provide an additional opportunity for students to assess and reinforce their understanding of the *NEC* and how to apply it on the job.
- Added Pro Tip, Safety, Code Applications, and Procedure features to enhance student learning.
- Expanded coverage on meters and measuring devices, types of cable and conduit, service calculations, surge protection devices, and more to ensure our content is aligned to HBI and NOCTI standards.
- Included an additional index of *NEC* references.

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Credentialing Partners and Support

Goodheart-Willcox appreciates the value of industry credentials, certifications, and accreditation. We are pleased to partner with leading organizations to support students and programs in achieving credentials. Integrating industry-recognized credentialing into a career and technical education (CTE) program provides many benefits for the student and for the institution. By achieving third-party certificates, students gain confidence, have proof of a measurable level of knowledge and skills, and earn a valuable achievement to include in their résumés. For educators and administrators, industry-recognized credentials and accreditation validate learning, enhance the credibility of programs, and provide valuable data to measure student performance and help guide continuous program improvement.

Residential Wiring Concepts and Applications is correlated to the House Wiring Basic, House Wiring Advanced, and PACT Basic Electrical credentials offered by the Home Builders Institute and Electrical Occupations and Electrical Construction Technology credentials offered by NOCTI.

HBI Certifications

Home Builders Institute (HBI) is the nation's leading provider of trade skills training in residential construction. HBI provides pre-apprenticeship training, certification programs, and job placement services to secondary school students, veterans and transitioning military personnel, displaced workers, and at-risk and justice-involved youth and adults. HBI trains in carpentry, electrical, plumbing, building construction technology, HVAC, landscaping, masonry, and solar installation.

HBI is a nonprofit organization that collaborates with public, private, and nonprofit partners dedicated to workforce development. Working with its partners, HBI attracts and certifies new students through a combination of hands-on training, innovation, and technology to build an emerging generation of skilled construction workers. For more information about HBI, visit www.hbi.org.

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To see how *Residential Wiring Concepts and Applications* correlates to credentialing and certification standards, visit the Correlations tab at www.g-w.com/residential-wiring-concepts-applications-2027.

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Features of the Textbook

The instructional design of this textbook includes student-focused learning tools to help you succeed. This visual guide highlights these features.

Chapter Opening Materials

Each chapter opener contains a list of learning objectives, a list of technical terms, a Sparking Discussion question, and an introduction.

Learning Outcomes clearly identify the knowledge and skills to be gained when the chapter is completed. These outcomes are labeled and correlated to related assessment elements to facilitate reporting and remediation.

Technical Terms list the key words to be learned in the chapter.

Sparking Discussion questions ask about topics covered in the chapter to preemptively spark engagement and critical thinking with the content.

The **Introduction** provides an overview of the chapter content.

Additional Features

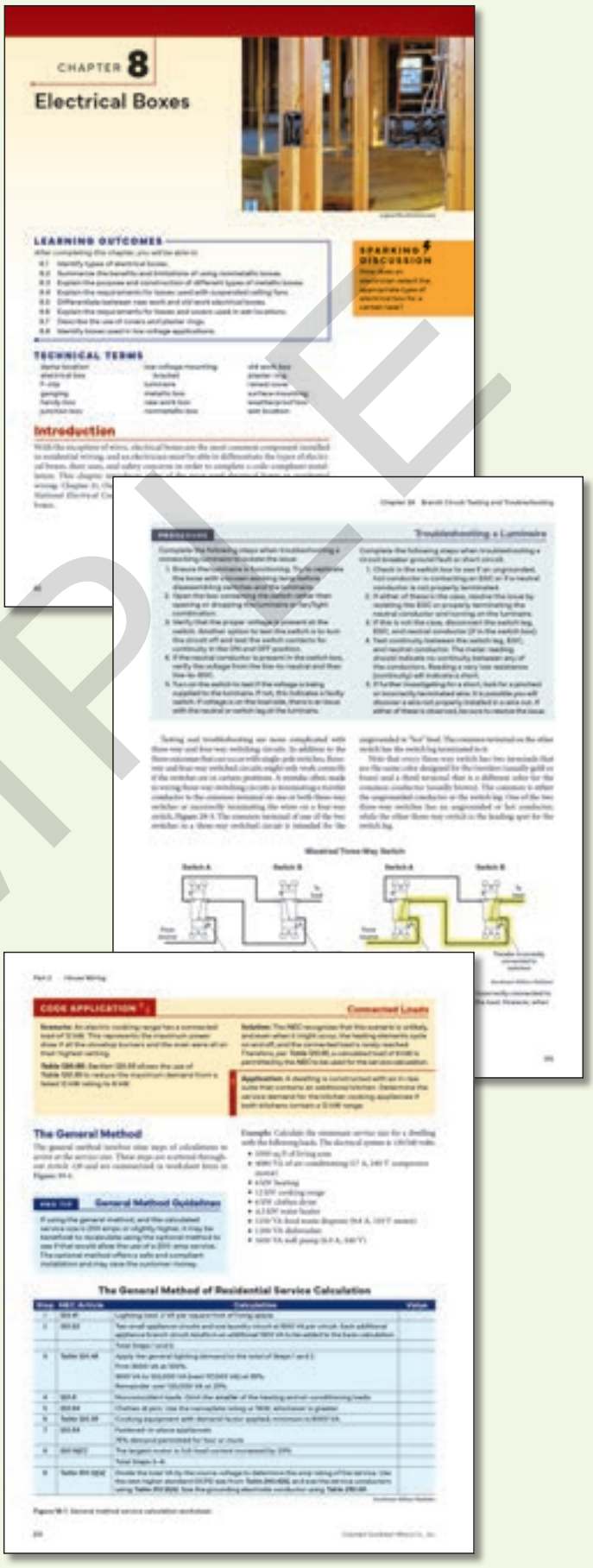
Additional features are used throughout the body of each chapter to further learning and knowledge.

Pro Tips provide advice and guidance that is especially applicable for on-the-job situations.

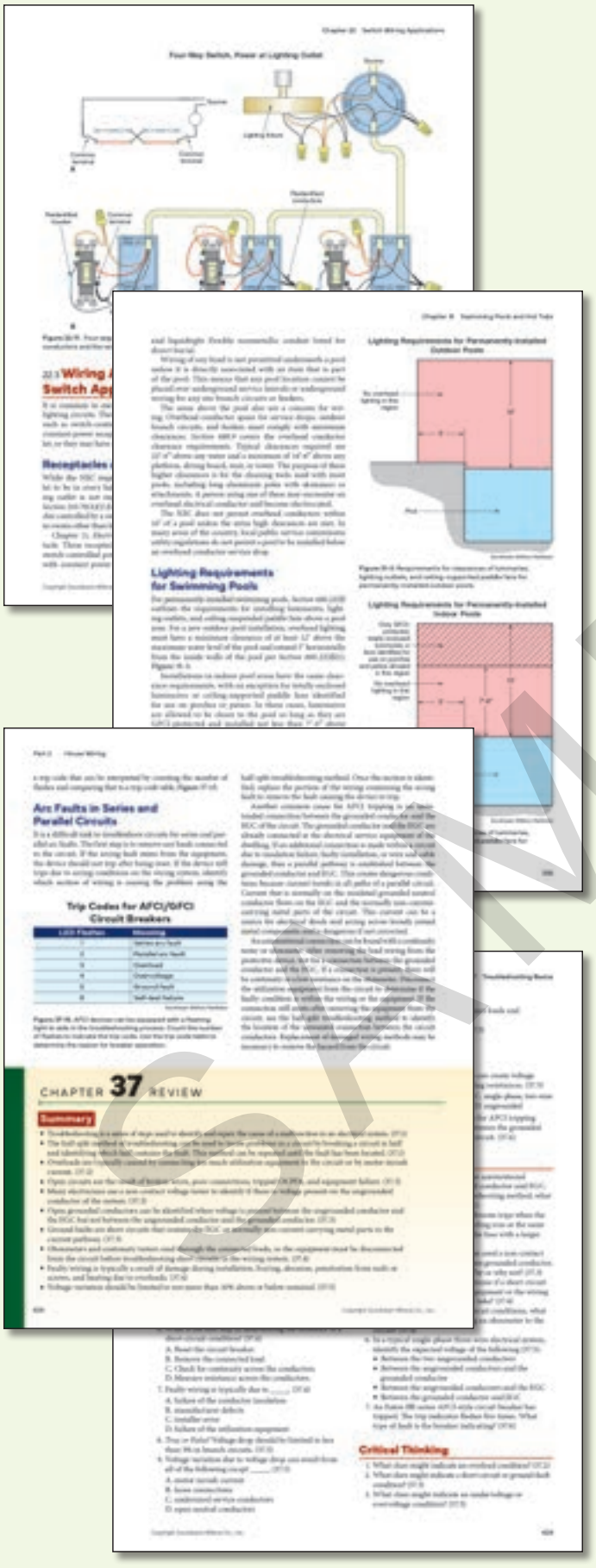
Safety Notes alert you to potentially dangerous materials and practices.

Code Applications provide opportunities to apply understanding of the *National Electrical Code* to different scenarios. An *Application* section poses an additional question for further practice.

Procedures provide clear instructions for hands-on tasks at a jobsite.



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Illustrations

The art program has been designed to add visual interest with depictions of jobsites, tools, and devices as an electrician would encounter them; to clearly communicate a specific topic, method, or concept; and to visualize the complex requirements listed in the *NEC*.

Illustrations and **diagrams** have been updated to provide further clarity.

Photographic **images** have been updated to show tools and devices in real-world applications as well as to showcase the latest equipment.

Figures of *NEC* tables reflect changes made to the 2026 edition.

End-of-Chapter Content

End-of-chapter material provides an opportunity for reviewing key concepts and applying knowledge gained in the chapter to real-world scenarios.

A concise **Summary** provides an additional review tool and reinforces key learning objectives. This helps you focus on important concepts presented in the text.

Know and Understand questions enable you to demonstrate knowledge, identification, and comprehension of chapter material.

Apply and Analyze questions extend learning and develop your abilities to use learned material in new situations and to break down material into its component parts.

Critical Thinking questions develop higher-order thinking and problem-solving abilities.

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TOOLS FOR STUDENT AND INSTRUCTOR SUCCESS

Student Tools



Student Text

Available in print and digital, *Residential Wiring Concepts and Applications* is a comprehensive text that focuses on the information, requirements, techniques, processes, and procedures used by residential electricians.

Lab Workbook

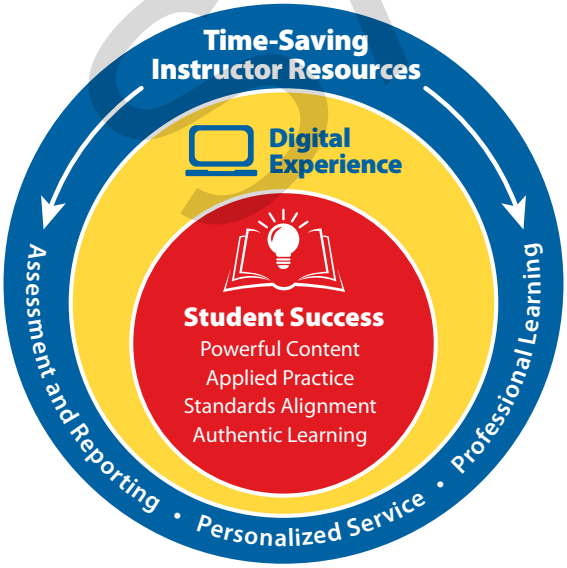
- Hands-on practice includes chapter review questions and activities.
- Activities offer opportunities to engage with complex concepts, processes, and procedures while working with devices, tools, and equipment that students may encounter on a jobsite.
- Print and digital options are available.

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