Preface

The purpose of *Modern Commercial Wiring* is to help the electrical practitioner—student, apprentice, journeyman, designer, engineer, contractor, and maintenance person—working in the commercial electrical trade. This textbook is written in clear and simple language from a knowledgeable electrician.

Basic electrical concepts and theory are explained, but this text assumes you have some prior knowledge and experience with electrical wiring and principles. Every chapter is geared toward providing you with design criteria, methods, and requirements of the 2026 NFPA®, *National Electrical Code®* (*NEC®*)*. Accuracy has been maintained to provide useful instruction and guidance that can be implemented in the real, day-to-day practices of commercial wiring. This includes (but is not restricted to) installing, designing, troubleshooting, and maintaining electrical systems, devices, and equipment.

The chapters are arranged in a logical sequence but are not dependent on one another. Each could be studied as a stand-alone entity. The chapters begin with clear objectives and close with review questions to reinforce what has been learned. Hopefully, this volume will provide many instructive and useful bits of information to the reader.

Harvey N. Holzman

About the Author

Harvey N. Holzman is a licensed master electrician with over 45 years of hands-on experience in several states, including New York, Florida, Kansas, North Carolina, Pennsylvania, and Texas. Besides owning his own electrical contracting services company, Mr. Holzman has worked for several major constructors at both refineries and power generating stations, providing consulting, supervision, and field engineering. He has been a member of many electrical trade organizations and has trained dozens of individuals, many of whom have gone on to become master electricians.

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Reviewers

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New to This Edition

The following changes were made to the 10th edition of *Modern Commercial Wiring* to strengthen the integrated learning solution and to remain current with professional codes:

- Content and tables have been updated to correspond with the 2026 version of the *National Electrical Code*.
- All learning outcomes, summary bullets, and end-of-chapter questions and activities were reviewed and aligned with each one-head section in every chapter, allowing for instructor flexibility in presenting and assigning textbook content in the classroom.

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

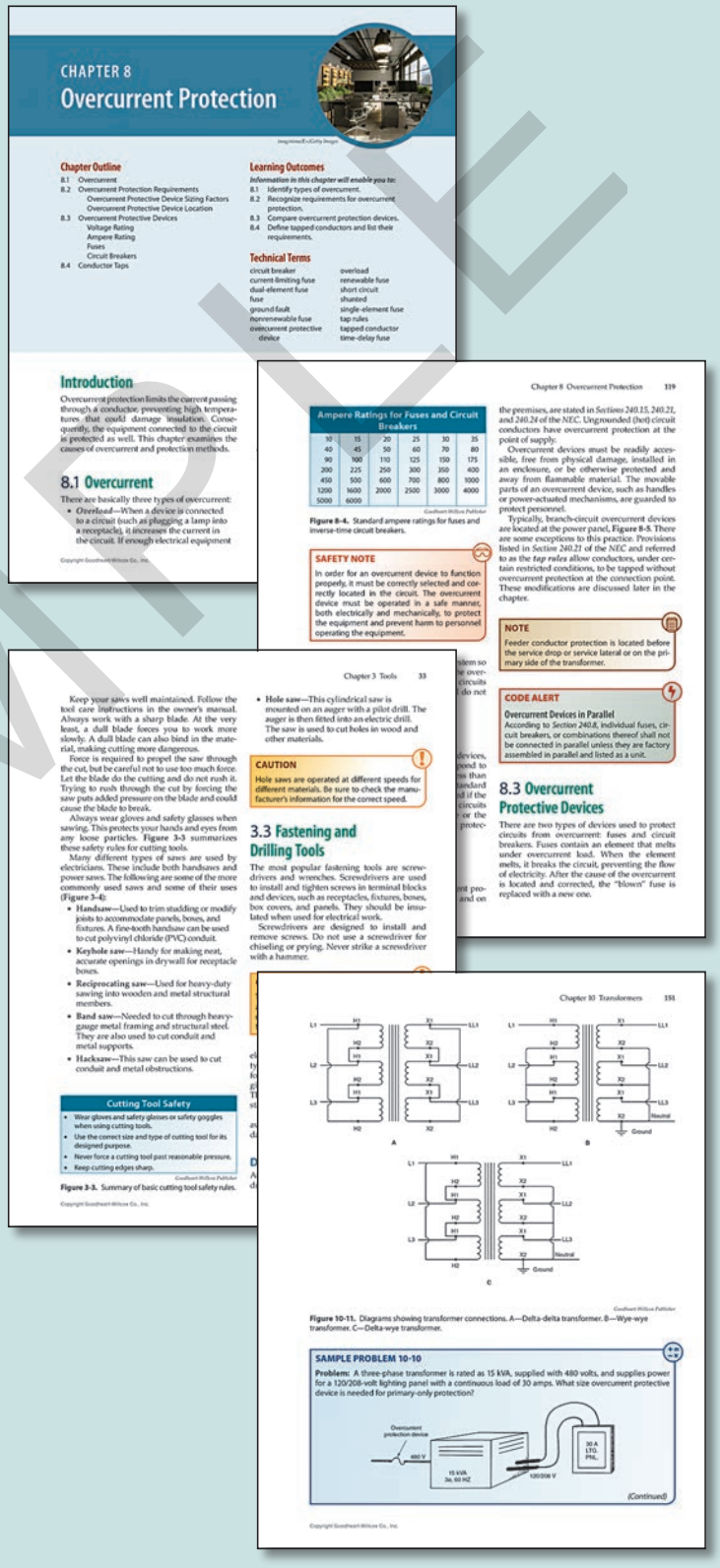
Each chapter opener contains a chapter outline, a list of learning outcomes, a list of technical terms, and an introduction to the chapter. The **Chapter Outline** summarizes the topics that will be covered in the chapter. **Learning Outcomes** clearly identify the knowledge and skills to be gained when 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. **Introduction** provides an overview and preview of the chapter content.

Additional Features

Additional features are used throughout the body of each chapter to further learning and knowledge. **Safety Notes** alert you to potentially dangerous materials and practices. **Cautions** alert you to practices that could potentially damage equipment or instruments. **Code Alerts** point out specific items from typical building codes. **Notes** give you expanded information on topics and practices. **Sample Problems** give you step-by-step instructions for applying practical mathematical concepts.

Illustrations

Illustrations have been designed to clearly and simply communicate the specific topic.



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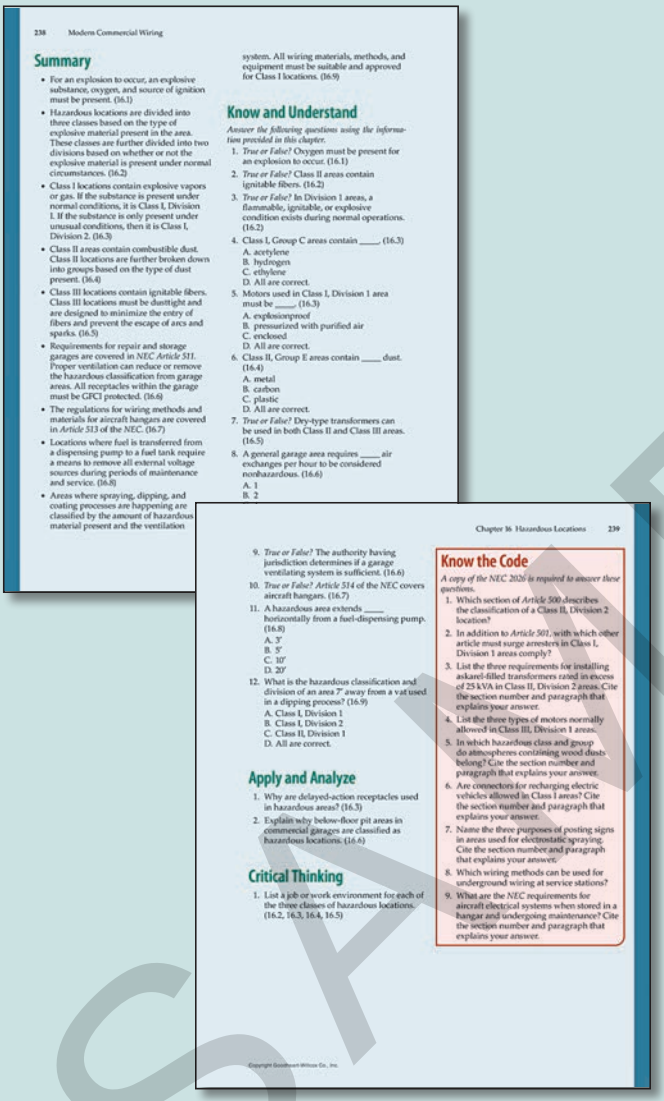

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Summary

- For an explosion to occur, an explosive substance, oxygen, and source of ignition must be present. (16.1)
- Hazardous locations are divided into three classes based on the type of explosive material present in the area. These classes are further divided into two divisions based on whether or not the explosive material is present under normal circumstances. (16.2)
- Class I locations contain explosive vapors or gas. If the substance is present under normal conditions, it is Class I, Division 1. If the substance is only present under unusual conditions, then it is Class I, Division 2. (16.3)
- Class II areas contain combustible dust. Class II locations are further broken down into groups based on the type of dust present. (16.4)
- Class III locations contain ignitable fibers. Class III locations must be dusttight and are designed to minimize the entry of fibers and prevent the escape of arcs and sparks. (16.5)
- Requirements for repair and storage garages are covered in *NEC Article 511*. Proper ventilation can reduce or remove the hazardous classification from garage areas. All receptacles within the garage must be GFCI protected. (16.6)
- The regulations for wiring methods and materials for aircraft hangars are covered in *Article 513* of the *NEC*. (16.7)
- Locations where fuel is transferred from a dispensing pump to a fuel tank require a means to remove all external voltage sources during periods of maintenance and service. (16.8)
- Areas where spraying, dipping, and coating processes are happening are classified by the amount of hazardous material present and the ventilation system. All wiring materials, methods, and equipment must be suitable and approved for Class I locations. (16.9)

Know and Understand

Answer the following questions using the information provided in this chapter.

1. *True or False?* Oxygen must be present for an explosion to occur. (16.1)
2. *True or False?* Class II areas contain ignitable fibers. (16.2)
3. *True or False?* In Division 1 areas, a flammable, ignitable, or explosive condition exists during normal operations. (16.2)
4. Class I, Group C areas contain ____. (16.3)
   A. acetylene
   B. hydrogen
   C. ethylene
   D. All are correct.
5. Motors used in Class I, Division 1 area must be ____. (16.3)
   A. explosionproof
   B. pressurized with purified air
   C. enclosed
   D. All are correct.
6. Class II, Group E areas contain ____ dust. (16.4)
   A. metal
   B. carbon
   C. plastic
   D. All are correct.
7. *True or False?* Dry-type transformers can be used in both Class II and Class III areas. (16.5)
8. A general garage area requires ____ air exchanges per hour to be considered nonhazardous. (16.6)
   A. 1
   B. 2

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9. *True or False?* The authority having jurisdiction determines if a garage ventilating system is sufficient. (16.6)
10. *True or False? Article 514* of the *NEC* covers aircraft hangars. (16.7)
11. A hazardous area extends ____ horizontally from a fuel-dispensing pump. (16.8)
    A. 3'
    B. 5'
    C. 10'
    D. 20'
12. What is the hazardous classification and division of an area 7' away from a vat used in a dipping process? (16.9)
    A. Class I, Division 1
    B. Class I, Division 2
    C. Class II, Division 1
    D. All are correct.

Apply and Analyze

1. Why are delayed-action receptacles used in hazardous areas? (16.3)
2. Explain why below-floor pit areas in commercial garages are classified as hazardous locations. (16.6)

Critical Thinking

1. List a job or work environment for each of the three classes of hazardous locations. (16.2, 16.3, 16.4, 16.5)

Know the Code

A copy of the NEC 2026 is required to answer these questions.

1. Which section of *Article 500* describes the classification of a Class II, Division 2 location?
2. In addition to *Article 501*, with which other article must surge arresters in Class I, Division 1 areas comply?
3. List the three requirements for installing askarel-filled transformers rated in excess of 25 kVA in Class II, Division 2 areas. Cite the section number and paragraph that explains your answer.
4. List the three types of motors normally allowed in Class III, Division 1 areas.
5. In which hazardous class and group do atmospheres containing wood dusts belong? Cite the section number and paragraph that explains your answer.
6. Are connectors for recharging electric vehicles allowed in Class I areas? Cite the section number and paragraph that explains your answer.
7. Name the three purposes of posting signs in areas used for electrostatic spraying. Cite the section number and paragraph that explains your answer.
8. Which wiring methods can be used for underground wiring at service stations?
9. What are the *NEC* requirements for aircraft electrical systems when stored in a hangar and undergoing maintenance? Cite the section number and paragraph that explains your answer.

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End-of-Chapter Content

End-of-chapter material provides an opportunity for review and application of concepts. A concise **Summary** provides an additional review tool and reinforces key learning outcomes. 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. **Know the Code** helps you become familiar with using the *National Electrical Code*.

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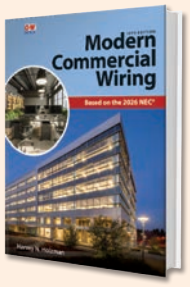
TOOLS FOR STUDENT AND INSTRUCTOR SUCCESS

Student Tools

Student Text



Available in print and digital, *Modern Commercial Wiring* provides effective, student-friendly instruction regarding the complex wiring requirements associated with commercial installations.

Workbook

- Minds-on practice with questions and activities.
- Each chapter corresponds to the text and reinforces key concepts and applied knowledge.

G-W Digital Companion

E-flash cards and vocabulary exercises allow interaction with content to create opportunities to master terminology.

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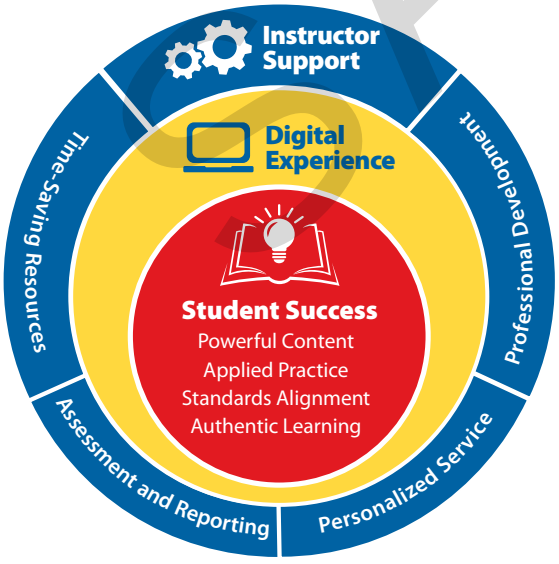

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The *National Electrical Code*®

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)*. The *code* establishes a set of rules, regulations, and criteria for the installation of electrical equipment. Compliance with these methods will result in a 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 *National Electrical Code* can be purchased from the National Fire Protection Association by visiting their website. Online access to the *National Electrical Code* 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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