

TRAINING FOR THE **TRADES**

RESIDENTIAL WIRING for the Trades

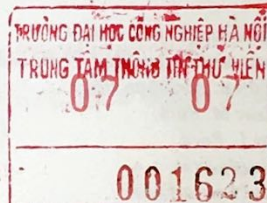


H. Brooke Stauffer



RESIDENTIAL WIRING FOR THE TRADES

H. Brooke Stauffer



GIFT OF THE ASIA FOUNDATION
NOT FOR RE-SALE

QUÀ TẶNG CỦA QUỸ CHÂU Á
KHÔNG ĐƯỢC BÁN LẠI



Higher Education

Boston Burr Ridge, IL Dubuque, IA Madison, WI New York San Francisco St. Louis
Bangkok Bogotá Caracas Kuala Lumpur Lisbon London Madrid Mexico City
Milan Montreal New Delhi Santiago Seoul Singapore Sydney Taipei Toronto

Contents

PREFACE	vii
About the Author	ix

CHAPTER 1 **General Principles** **1**

Scope	2
Overview of the <i>NEC</i>	2
Special Rules for Wiring Dwelling Units	4
Other Codes and Regulatory Requirements	6
Symbols for Residential Wiring	19
Basics of Residential Electrical Systems	20
Definitions for Residential Wiring	24
Chapter Review	26

CHAPTER 2 **Planning the Installation Required Branch Circuits and Load Calculations** **29**

Residential Branch Circuits	30
Planning the Installation	34
Determining the Required Number of Branch Circuits	35
Calculating the Service Load	40
Computing Dwelling Unit Floor Area for Service Load Calculations	45
Two-Family Dwellings	49
Chapter Review	53

CHAPTER 3 **Services, Service Equipment, and Grounding** **55**

Selecting Service Equipment	56
Services	63
Service Point	71
Sizing Service-Entrance Conductors and Raceways	73
Grounding	75
Chapter Review	86

CHAPTER 4 **Wiring Methods** **89**

General Wiring Rules for Dwellings	90
Nonmetallic-Sheathed Cable (Type NM)	92

Armored Cable (Type AC)	99
Box Fill and Selection	103
General Requirements for Installing Boxes	108
Tubular Raceways	111
Surface Raceways	120
Installing Conductors in Raceways	120
Using Oversized Conductors to Minimize Voltage Drop	122
Chapter Review	123

CHAPTER 5 Lighting the Home 127

Basics of Lamps and Luminaires	128
Lighting Outlets and Switches	131
Thermal Protection of Luminaires	135
Bathroom Lighting	138
Closet Lighting	139
Lighting Track	141
Boxes for Luminaires and Paddle Fans	142
Types of Switches and Controls Used in Homes	145
Installation of Switches	147
Grounding Switches and Faceplates	154
Dimmer Controls for Homes	154
Chapter Review	158

CHAPTER 6 The Living Room 161

Basic Concepts	162
Receptacle Outlets in the Living Room	163
Lighting and Switching in the Living Room	167
Recommended Heights for Wall-Mounted Outlets	169
Circuiting for the Living Room	170
Chapter Review	174

CHAPTER 7 The Kitchen and Dining Room 177

Receptacle Outlets in the Kitchen and Dining Room	178
Lighting and Switching in the Kitchen and Dining Room	185
Ranges, Wall-Mounted Ovens, and Counter-Mounted Cooking Units (Cooktops)	186
Other Kitchen Appliances	190
Special Systems	192
Chapter Review	194

CHAPTER 8 The Bathroom 197

Receptacle Rules for Bathrooms	198
Ground-Fault Circuit Interrupters	202
Bathroom Lighting	204
Other Rules for Bathrooms	206

Additional Shock Protection Requirements	208
Chapter Review	210

CHAPTER 9 The Bedroom 213

Locating Receptacle Outlets in Bedrooms	214
Arc-Fault Circuit Interrupters	214
Luminaires and Paddle Fans	220
Bedroom Closet Lighting	222
Branch Circuits in Bedrooms	223
Chapter Review	225

CHAPTER 10 The Basement, Family Room, and Laundry 229

Unfinished Basement Areas	230
Family Rooms and Wet Bars	234
Laundry Rooms	236
Bedrooms in Basement Areas	238
Chapter Review	240

CHAPTER 11 Hallways, Stairways, and Attics 243

Lighting and Receptacles in Hallways	244
Lighting and Receptacles in Stairways	246
Lighting, Switching, and Receptacles in Attics	248
Chapter Review	251

CHAPTER 12 Outdoor Areas 253

Outdoor Electrical Installations	254
Outdoor Receptacle Outlets	254
Outdoor Lighting	258
Underground Wiring	263
Garages and Accessory Buildings	265
Chapter Review	271

CHAPTER 13 Swimming Pools, Hot Tubs, and Spas 275

Overview of Swimming Pool, Hot Tub, and Spa Installations	276
Required Clearances for Outdoor Pools	276
Required Clearances for Luminaires and Ceiling-Suspended (Paddle) Fans	279
Underwater Pool Lighting: 120 Volts	281
Low-Voltage Pool Lighting: 12 Volts	284
Power Distribution: General Considerations	286
Grounding, Bonding, and GFCI Protection	289
Storable Pools	293
Other Pool Equipment	293

Spas and Hot Tubs	294
Chapter Review	297

CHAPTER 14 HVAC Equipment and Water Heaters 301

Central Heating Equipment	302
Central Air-Conditioning Equipment	304
Heat Pumps	306
Thermostats and Class 2 Wiring	306
Room Air Conditioners	307
Electric Baseboard Heaters	308
Water Heaters	312
Chapter Review	315

CHAPTER 15 Special Systems 317

Telephones	318
Cable Television	322
Smoke Detectors and Alarm Systems	325
Door Chimes	329
Residential Structured Cabling Systems	331
Chapter Review	337

CHAPTER 16 Residential Generators 339

Separately Derived Systems	340
Planning the Installation	340
Installing Generator Sets and Associated Components	345
Chapter Review	348

CHAPTER 17 Old Work 351

Basic Concepts	352
Installing New Electrical Boxes in Old Work	352
Installing New Cables in Old Work	353
Surface Raceways	354
Surface Extensions	356
Replacing Wiring Devices in Old Work	357
Chapter Review	363

NEC Definitions 365

Answers 372

Index 399

Preface

Overview

Residential Wiring for the Trades is a practical guide for wiring homes according to *National Electrical Code*® rules. It covers *Code* requirements and actual construction practices for installing electrical systems in new one- and two-family dwellings.

This book contains explanations of many technical requirements in the *NEC*®, and the safety-based intent behind them, to give students a fuller and more comprehensive understanding of the *Code*.

Residential Wiring for the Trades combines in-depth instruction about 2005 *NEC* rules with detailed, hands-on, information about real life residential wiring practices. It is a textbook for electrician apprenticeship programs, vocational-technical schools, inspector training, and other educational, training, and certification programs.

Features

Clear text and more than 200 color illustrations provide a thorough understanding of the residential wiring requirements of the 2005 *National Electrical Code*. Students learn how to design and install residential electrical systems in one- and two-family dwellings, in accordance with all applicable *Code* rules. Important features include:

- General principles that guide the development of *NEC* requirements
- Design of residential electrical systems, including load calculations
- Specific *Code* rules that apply to different rooms and areas of dwellings
- Wiring methods used in residential construction
- *NEC* rules that apply specifically to two-family dwellings
- Important *NEC* terms are listed at the beginning of each chapter
- Official *NEC* definitions that apply to electrical systems in dwellings are extracted from Article 100 of the *NEC* and listed at the end of the book
- Detailed coverage of safety begins in Chapter 1 and is stressed throughout the book
- Chapter 17, Old Work, covers the important topic of additions and modifications to existing residential wiring systems
- Chapter Review sections test student knowledge with an array of multiple choice, true or false, and fill in the blank questions
- Challenge Questions at the end of each unit provide critical thinking situations for students to analyze

Instructor Resources

The following companion pieces are available for use with the textbook on the Instructor Productivity Center (IPC) CD ROM: