



# TABLE OF CONTENTS

**About This Textbook** ..... xiii

**About the *National Electrical Code*** ..... xvii

**About the Author** ..... xxi

**About the Illustrator** ..... xxii

**About the Team** ..... xxiii

**Article 90—Introduction to the *National Electrical Code*** ..... 1

90.1 Purpose of the *NEC* ..... 1

90.2 Scope of the *NEC* ..... 3

90.3 Code Arrangement ..... 5

90.4 Enforcement ..... 6

90.5 Mandatory Requirements and Explanatory Material ..... 8

90.6 Formal Interpretations ..... 8

90.7 Examination of Equipment for Product Safety ..... 8

90.9 Units of Measurement ..... 9

**Article 90 Practice Questions** ..... 10

## CHAPTER 5—SPECIAL OCCUPANCIES ..... 13

**Article 500—Hazardous (Classified) Locations** ..... 15

500.1 Scope—Articles 500 Through 504 ..... 16

500.2 Definitions ..... 16

500.3 Other Articles ..... 17

500.4 General ..... 17

500.5 Classifications of Locations ..... 18

500.6 Material Groups ..... 20

500.7 Protection Techniques ..... 20

500.8 Equipment ..... 22

500.9 Specific Occupancies ..... 25

**Article 501—Class I Hazardous (Classified) Locations** ..... 27

**Part I. General** ..... 27

501.1 Scope ..... 27

**Part II. Wiring** ..... 27

501.10 Wiring Methods ..... 27

501.15 Raceway and Cable Seals ..... 30

501.20 Conductor Insulation ..... 36

501.30 Grounding and Bonding ..... 36

**Part III. Equipment** ..... 37

501.100 Transformers and Capacitors ..... 37

501.105 Meters, Instruments, and Relays ..... 37

501.115 Enclosures ..... 37

501.120 Control Transformers and Relays ..... 38

501.125 Motors ..... 38

501.130 Luminaires ..... 39

501.135 Utilization Equipment ..... 40

501.140 Flexible Cords ..... 40

501.145 Receptacles and Attachment Plugs ..... 41

501.150 Limited-Energy and Communications Systems ..... 42

## Article 502—Class II Hazardous (Classified) Locations ..... 43

**Part I. General** ..... 43

502.1 Scope ..... 43

502.5 Explosionproof Equipment ..... 43

**Part II. Wiring** ..... 44

502.10 Wiring Methods ..... 44

502.15 Seals ..... 46

502.30 Grounding and Bonding ..... 47

**Part III. Equipment** ..... 48

502.115 Switches, Circuit Breakers, Motor Controllers, and Fuses ..... 48

502.120 Control Transformers ..... 49

502.125 Motors ..... 49

502.130 Luminaires ..... 49

502.140 Flexible Cords ..... 51

502.145 Receptacles and Attachment Plugs ..... 51

502.150 Limited-Energy and Communications Systems ..... 52

**Article 503—Class III Hazardous (Classified)**

**Locations** ..... 53

**Part I. General** ..... 53

503.1 Scope ..... 53

503.5 General ..... 53

**Part II. Wiring** ..... 53

503.10 Wiring Methods..... 53

503.30 Grounding and Bonding..... 54

**Part III. Equipment**..... 55

503.115 Switches, Circuit Breakers, Motor Controllers,  
and Fuses ..... 55

503.120 Control Transformers..... 56

503.125 Motors ..... 56

503.130 Luminaires..... 56

503.140 Flexible Cords ..... 56

503.145 Receptacles and Attachment Plugs ..... 57

503.150 Limited-Energy and Communications Systems ..... 57

**Article 511—Commercial Garages, Repair, and Storage** ..... 59

511.1 Scope ..... 59

511.2 Definitions..... 60

511.3 Classification of Hazardous Areas ..... 60

511.4 Wiring and Equipment in Hazardous (Classified)  
Locations ..... 63

511.7 Wiring and Equipment Above Hazardous (Classified)  
Locations ..... 63

511.9 Seals..... 64

511.10 Special Equipment ..... 64

511.12 GFCI-Protected Receptacles..... 64

**Article 514—Motor Fuel Dispensing Facilities** ..... 67

514.1 Scope ..... 67

514.2 Definition ..... 67

514.3 Classification of Locations..... 68

514.4 Wiring and Equipment Within Class I Locations ..... 69

514.7 Wiring and Equipment Above Class I Locations ..... 69

514.8 Underground Wiring ..... 70

514.9 Raceway Seal ..... 70

514.11 Circuit Disconnect..... 71

514.13 Maintenance and Service of Dispensing Equipment..... 71

514.16 Grounding and Bonding..... 71

**Article 517—Health Care Facilities** ..... 73

**Part I. General** ..... 74

517.1 Scope ..... 74

517.2 Definitions..... 74

**Part II. Wiring and Protection**..... 75

517.10 Applicability ..... 75

517.12 Wiring Methods..... 76

517.13 Grounding of Equipment in Patient Care Spaces..... 76

517.16 Isolated Ground Receptacles ..... 78

517.18 General Care Areas ..... 79

**Part VI. Communications and Signaling Systems**..... 79

517.80 Patient Care Spaces..... 79

517.81 Other-Than-Patient-Care Areas ..... 79

**Article 518—Assembly Occupancies** ..... 81

518.1 Scope ..... 81

518.2 General Classifications..... 81

518.3 Other Articles ..... 82

518.4 Wiring Methods..... 82

**Article 525—Carnivals, Circuses, Fairs, and Similar Events** ..... 85

**Part I. General Requirements** ..... 85

525.1 Scope ..... 85

525.2 Definitions..... 85

525.3 Other Articles ..... 86

525.5 Overhead Conductor Clearances ..... 86

525.6 Protection of Electrical Equipment..... 87

**Part II. Power Sources** ..... 87

525.10 Services..... 87

525.11 Multiple Sources of Supply..... 87

**Part III. Wiring Methods** ..... 87

525.20 Wiring Methods..... 87

525.21 Rides, Tents, and Concessions ..... 88

525.22 Outdoor Portable Distribution or Termination Boxes..... 88

525.23 GFCI-Protected Receptacles and Equipment ..... 88

**Part IV. Grounding and Bonding**..... 89

525.30 Equipment Bonding..... 89

525.31 Equipment Grounding ..... 89

525.32 Portable Equipment Grounding Conductor Continuity ..... 89



**Part VIII. Machine Rooms, Control Rooms, Machinery Spaces, and Control Spaces** ..... 142

620.85 GFCI-Protected Receptacles ..... 142

**Article 625—Electric Vehicle Charging System** ..... 145

**Part I. General** ..... 146

625.1 Scope ..... 146

625.2 Definitions ..... 146

625.5 Listed ..... 147

**Part II. Equipment Construction** ..... 148

625.15 Markings ..... 148

625.22 Personnel Protection System ..... 148

**Part III. Installation** ..... 148

625.40 Overcurrent Protection ..... 148

625.41 Rating ..... 148

625.42 Disconnecting Means ..... 148

625.50 Location ..... 148

625.52 Ventilation ..... 149

**Article 640—Audio Signal Processing, Amplification, and Reproduction Equipment** ..... 151

**Part I. General** ..... 151

640.1 Scope ..... 151

640.2 Definitions ..... 152

640.3 Locations and Other Articles ..... 152

640.4 Protection of Electrical Equipment ..... 152

640.6 Mechanical Execution of Work ..... 152

640.7 Grounding and Bonding ..... 154

640.9 Wiring Methods ..... 154

640.10 Audio Systems Near Bodies of Water ..... 155

**Part II. Permanent Audio System Installations** ..... 155

640.21 Use of Flexible Cords and Flexible Cables ..... 155

640.23 Number of Conductors in a Raceway ..... 155

640.25 Loudspeakers in Fire-Resistance-Rated Partitions, Walls, and Ceilings ..... 155

**Article 645—Information Technology Equipment** ..... 157

645.1 Scope ..... 157

645.2 Definitions ..... 157

645.3 Other Articles ..... 158

645.4 Information Technology Equipment Room ..... 158

645.5 Supply Circuits and Interconnecting Cables ..... 158

645.6 Cables Not in Information Technology Equipment Room ..... 161

645.10 Disconnecting Means ..... 161

645.11 Uninterruptible Power Supplies (UPS) ..... 161

645.14 System Grounding ..... 161

645.15 Equipment Grounding and Bonding ..... 162

**Article 680—Swimming Pools, Spas, Hot Tubs, Fountains, and Similar Installations** ..... 163

**Part I. General Requirements for Pools, Spas, Hot Tubs, and Fountains** ..... 164

680.1 Scope ..... 164

680.2 Definitions ..... 164

680.3 Other Articles ..... 166

680.7 Cord-and-Plug-Connected Equipment ..... 166

680.8 Overhead Conductor Clearance ..... 167

680.9 Electric Water Heaters ..... 168

680.10 Underground Wiring ..... 168

680.11 Equipment Rooms and Pits ..... 168

680.12 Maintenance Disconnecting Means ..... 169

**Part II. Permanently Installed Pools, Outdoor Spas, and Outdoor Hot Tubs** ..... 169

680.20 General ..... 169

680.21 Motors ..... 169

680.22 Lighting, Receptacles, and Equipment ..... 170

680.23 Underwater Luminaires ..... 173

680.24 Junction Box, Transformer, or GFCI Enclosure ..... 175

680.25 Feeders ..... 177

680.26 Equipotential Bonding ..... 178

680.27 Specialized Equipment ..... 181

**Part III. Storable Pools, Storable Spas, and Storable Hot Tubs** ..... 181

680.30 General ..... 181

680.31 Pumps ..... 181

680.32 GFCI-Protected Receptacles ..... 181

680.34 Receptacle Locations ..... 181

**Part IV. Spas and Hot Tubs** ..... 182

680.40 General ..... 182

680.41 Emergency Switch for Spas and Hot Tubs ..... 182

680.42 Outdoor Installations ..... 182

680.43 Indoor Installations ..... 183

680.44 GFCI Protection ..... 185

**Part V. Fountains** ..... 185

680.50 General ..... 185

680.51	Luminaires, Submersible Pumps, and Other Submersible Equipment.....	186	<b>Part VI. Overcurrent Protection</b> .....	212	
680.53	Bonding.....	186	700.26	Accessibility.....	212
680.55	Methods of Equipment Grounding.....	186	700.27	Ground-Fault Protection of Equipment.....	212
680.56	Cord-and-Plug-Connected Equipment.....	186	700.28	Selective Coordination.....	212
680.57	Signs in or Adjacent to Fountains.....	187	<b>Article 701—Legally Required Standby Systems</b> ....	213	
680.58	GFCI-Protected Receptacles.....	187	<b>Part I. General</b> .....	213	
<b>Part VII. Hydromassage Bathtubs</b> .....		187	701.1	Scope.....	213
680.70	General.....	187	701.2	Definitions.....	213
680.71	GFCI Protection.....	187	701.3	Tests and Maintenance.....	214
680.72	Other Electrical Equipment.....	188	701.4	Capacity and Rating.....	214
680.73	Accessibility.....	188	701.5	Transfer Equipment.....	214
680.74	Equipotential Bonding.....	188	701.7	Signs.....	214
<b>Article 695—Fire Pumps</b> .....		191	<b>Part II. Circuit Wiring</b> .....	215	
695.1	Scope.....	191	701.10	Wiring.....	215
695.3	Power Source(s).....	192	<b>Part III. Sources of Power</b> .....	215	
695.4	Continuity of Power.....	192	701.12	General Requirements.....	215
695.5	Transformers.....	194	<b>Part IV. Overcurrent Protection</b> .....	216	
695.6	Power Wiring.....	194	701.25	Accessibility.....	216
695.7	Voltage Drop.....	195	701.26	Ground-Fault Protection of Equipment.....	216
695.14	Control Wiring.....	196	701.27	Selective Coordination.....	216
<b>Chapter 6 Practice Questions</b> .....		197	<b>Article 702—Optional Standby Systems</b> .....	217	
<b>CHAPTER 7—SPECIAL CONDITIONS</b> .....		203	<b>Part I. General</b> .....	217	
<b>Article 700—Emergency Systems</b> .....		205	702.1	Scope.....	217
<b>Part I. General</b> .....		205	702.2	Definition.....	218
700.1	Scope.....	205	702.4	Capacity and Rating.....	218
700.2	Definitions.....	206	702.5	Transfer Equipment.....	219
700.3	Tests and Maintenance.....	206	702.7	Signs.....	219
700.4	Capacity.....	206	<b>Part II. Circuit Wiring</b> .....	220	
700.5	Transfer Equipment.....	207	702.10	Wiring.....	220
700.7	Signs.....	207	702.12	Outdoor Generator Sets.....	220
700.8	Surge Protection.....	208	<b>Article 725—Remote-Control, Signaling, and Power-Limited Circuits</b> .....	221	
<b>Part II. Circuit Wiring</b> .....		208	<b>Part I. General</b> .....	221	
700.10	Wiring.....	208	725.1	Scope.....	221
<b>Part III. Sources of Power</b> .....		209	725.2	Definitions.....	222
700.12	General Requirements.....	209	725.3	Other Articles.....	223
<b>Part IV. Circuits for Lighting and Power</b> .....		211	725.21	Electrical Equipment Behind Access Panels.....	225
700.15	Loads on Emergency Branch Circuits.....	211	725.24	Mechanical Execution of Work.....	225
700.16	Emergency Illumination.....	211	725.25	Abandoned Cable.....	226
700.19	Multewire Branch Circuits.....	212			

725.31	Safety-Control Equipment .....	226	<b>Part III. Power-Limited Fire Alarm (PLFA) Circuits</b> .....	242	
725.35	Circuit Requirements .....	227	760.121	Power Sources for Power-Limited Fire Alarm Circuits.....	242
<b>Part II. Class 1 Circuit Requirements</b> .....		227	760.124	Equipment Marking.....	242
725.41	Class 1 Circuit Classifications and Power-Supply Requirements .....	227	760.130	Wiring Methods on Load Side of Power-Limited Fire Alarm Power Source .....	243
725.43	Class 1 Circuit Overcurrent Protection.....	228	760.135	Installation of PLFA Cables in Buildings .....	244
725.46	Class 1 Circuit Wiring Methods.....	228	760.136	Separation from Power Conductors.....	244
725.48	Conductors of Different Circuits in Same Cable, Cable Tray, Enclosure, or Raceway .....	228	760.139	Power-Limited Fire Alarm Circuits, Class 2, Class 3, and Communications Circuits .....	244
725.49	Class 1 Circuit Conductors .....	228	760.143	Support.....	245
725.51	Number of Conductors in a Raceway .....	229	760.154	Applications of Power-Limited Fire Alarm Cables (PLFA).....	245
<b>Part III. Class 2 and Class 3 Circuit Requirements</b> .....		229	<b>Part IV. Listing Requirements</b> .....	246	
725.121	Power Sources for Class 2 and Class 3 Circuits .....	229	760.179	Listing and Marking of Power-Limited Fire Alarm Cables (PLFA).....	246
725.124	Equipment Marking.....	230	<b>Article 770—Optical Fiber Cables and Raceways</b> .....		247
725.127	Wiring Methods on Supply Side of the Class 2 or Class 3 Power Source .....	230	<b>Part I. General</b> .....	247	
725.130	Wiring Methods on Load Side of the Class 2 or Class 3 Power Source .....	230	770.1	Scope .....	247
725.135	Installation of Class 2 and Class 3 Cables .....	230	770.2	Definitions.....	248
725.136	Separation from Power Conductors.....	231	770.3	Other Articles .....	248
725.139	Conductors of Different Circuits in Same Cable, Enclosure, Cable Tray, Raceway, or Cable Routing Assembly .....	233	770.12	Innerduct .....	249
725.143	Support.....	234	770.21	Access to Electrical Equipment Behind Panels Designed to Allow Access .....	250
725.154	Applications of Class 2, Class 3, and PLTC Cables.....	234	770.24	Mechanical Execution of Work .....	250
<b>Part IV. Listing Requirements</b> .....		235	770.25	Abandoned Cable.....	251
725.179	Listing and Marking of Class 2 and Class 3 Cables .....	235	770.26	Spread of Fire or Products of Combustion .....	252
<b>Article 760—Fire Alarm Systems</b> .....		237	<b>Part II. Cables Outside and Entering Buildings</b> .....	252	
<b>Part I. General</b> .....		237	770.48	Unlisted Cables and Raceways Entering Buildings.....	252
760.1	Scope .....	237	770.49	Metallic Entrance Conduit Grounding .....	252
760.2	Definitions.....	238	<b>Part V. Installation Methods Within Buildings</b> .....	253	
760.3	Other Articles .....	238	770.110	Raceways and Cable Routing Assemblies for Optical Fiber Cables .....	253
760.21	Access to Electrical Equipment Behind Panels Designed to Allow Access .....	240	770.113	Installation of Optical Fiber Cables .....	254
760.24	Mechanical Execution of Work .....	240	770.133	Installation of Optical Fiber Cables and Electrical Conductors .....	254
760.25	Abandoned Cable.....	241	770.154	Applications of Listed Optical Fiber Cables.....	256
760.30	Fire Alarm Circuit Identification .....	242	<b>Part VI. Listing Requirements</b> .....	256	
760.32	Fire Alarm Circuit Cables Extending Beyond a Building .....	242	770.179	Listing and Marking of Optical Fiber Cables .....	256
760.35	Fire Alarm Circuit Requirements.....	242	<b>Chapter 7 Practice Questions</b> .....		257

## CHAPTER 8—COMMUNICATIONS SYSTEMS

### Article 800—Communications Circuits

<b>Part I. General</b>	265
800.1 Scope	265
800.2 Definitions	266
800.12 Innerduct	266
800.18 Installation of Equipment	266
800.21 Access to Electrical Equipment Behind Panels Designed to Allow Access	267
800.24 Mechanical Execution of Work	267
800.25 Abandoned Cable	268
800.26 Spread of Fire or Products of Combustion	269
<b>Part II. Cables Outside and Entering Buildings</b>	269
800.44 Overhead (Aerial) Communications Wires and Cables	269
800.47 Underground Communications Wires and Cables Entering Buildings	269
800.48 Unlisted Cables Entering Buildings	270
800.49 Metallic Entrance Conduit Grounding	270
800.53 Lightning Conductors	270
<b>Part III. Protection</b>	270
800.90 Primary Protection	270
<b>Part IV. Grounding Methods</b>	271
800.100 Cable and Primary Protector Bonding and Grounding	271
<b>Part V. Installation Methods Within Buildings</b>	274
800.110 Raceways and Cable Routing Assemblies for Communications Wires and Cables	274
800.113 Installation of Communications Cables, Raceways, and Cable Routing Assemblies	275
800.133 Installation of Communications Wires, Cables, and Equipment	277
800.154 Applications of Communications Cables, Communications Raceways, and Cable Routing Assemblies	278
800.156 Dwelling Unit Communications Outlet	279
<b>Part VI. Listing Requirements</b>	280
800.179 Listing and Marking of Communications Wires and Cables	280
800.182 Listing and Marking of Communications Raceways	280

### Article 810—Radio and Television Equipment

<b>Part I. General</b>	281
810.1 Scope	281

810.3 Other Articles	282
810.4 Community Television Antenna	282
810.6 Antenna Lead-In Protectors	282
810.7 Grounding Devices	283

<b>Part II. Receiving Equipment—Antenna Systems</b>	283
810.12 Supports	283
810.13 Avoid Contact with Conductors of Other Systems	283
810.15 Metal Antenna Supports—Grounding	283
810.18 Clearances	284
810.20 Antenna Discharge Unit	284
810.21 Bonding Conductor and Grounding Electrode Conductors	285

<b>Part III. Amateur and Citizen Band Transmitting and Receiving Antenna Systems</b>	288
810.51 Other Sections	288
810.54 Clearance on Building	288
810.57 Antenna Discharge Units	288
810.58 Bonding Conductor or Grounding Electrode Conductors	288

### Article 820—Community Antenna Television (CATV) and Radio Distribution Systems

<b>Part I. General</b>	289
820.1 Scope	289
820.2 Definitions	290
820.15 Power Limitations	290
820.21 Access to Electrical Equipment Behind Panels Designed to Allow Access	291
820.24 Mechanical Execution of Work	291
820.25 Abandoned Cable	292
820.26 Spread of Fire or Products of Combustion	293
<b>Part II. Coaxial Cables Outside and Entering Buildings</b>	293
820.44 Supports	293
820.47 Underground Coaxial Cables Entering Buildings	294
820.48 Unlisted Cables and Raceways Entering Building	294
820.49 Metallic Entrance Conduit Grounding	294
<b>Part III. Protection</b>	295
820.93 Grounding of the Outer Conductive Shield of Coaxial Cables	295
<b>Part IV. Grounding Methods</b>	295
820.100 Bonding and Grounding Methods	295

**Part V. Installation Methods Within Buildings**..... 298

820.110 Raceways and Cable Routing Assemblies for  
Coaxial Cables ..... 298

820.113 Installation of Coaxial Cables..... 300

820.133 Installation of Coaxial Cables and Equipment ..... 301

820.154 Applications of Coaxial Cables ..... 302

**Part VI. Listing Requirements** ..... 303

820.179 Listing and Marking of Coaxial Cables..... 303

**Chapter 8 Practice Questions**..... 305

**FINAL EXAM A FOR UNDERSTANDING  
THE *NEC* CHAPTERS 5–8**..... 309

**FINAL EXAM B FOR UNDERSTANDING  
THE *NEC* CHAPTERS 5–8**..... 321

**INDEX**..... 333