Table of Contents

Introduction xi
About This Textbook xiii
How to Use the *National Electrical Code* xv
About the Author xviii
About the Graphic Illustrator xix
Mike Holt Enterprises Team xx

ARTICLE 90—INTRODUCTION TO THE NATIONAL ELECTRICAL CODE 1
90.1 Purpose of the *NEC* 1
90.2 Scope of the *NEC* 2
90.3 *Code* Arrangement 4
90.4 Enforcement 5
90.5 Mandatory Requirements and Explanatory Material 6
90.6 Formal Interpretations 7
90.7 Examination of Equipment for Product Safety 7
90.9 Units of Measurement 7

PRACTICE QUESTIONS FOR ARTICLE 90—INTRODUCTION 8

CHAPTER 5—SPECIAL OCCUPANCIES 11

ARTICLE 500—HAZARDOUS (CLASSIFIED) LOCATIONS 13
500.1 Scope—Articles 500 Through 504 13
500.2 Definitions 14
500.3 Other Articles 15
500.4 General 15
500.5 Classifications of Locations 16
500.6 Material Groups 18
500.7 Protection Techniques 18
500.8 Equipment 19
500.9 Specific Occupancies 21

ARTICLE 501—CLASS I HAZARDOUS (CLASSIFIED) LOCATIONS 23
Part I. General 23
501.1 Scope 23
Part II. Wiring 23
501.10 Wiring Methods 23
501.15 Raceway and Cable Seals 25
501.20 Conductor Insulation 29
501.30 Grounding and Bonding 29
Part III. Equipment 30
501.100 Transformers and Capacitors 30
501.105 Meters, Instruments, and Relays 31
501.115 Enclosures 31
501.120 Control Transformers and Relays 31
501.125 Motors 32
501.130 Luminaires 32
501.135 Utilization Equipment 33
501.140 Flexible Cords 33
501.145 Receptacles and Attachment Plugs 34
501.150 Limited-Energy and Communications Systems 34

ARTICLE 502—CLASS II HAZARDOUS (CLASSIFIED) LOCATIONS 35
Part I. General 35
502.1 Scope 35
502.5 Explosionproof Equipment 35
Part II. Wiring 36
502.10 Wiring Methods 36
502.15 Seals 37
502.30 Grounding and Bonding 37
Part III. Equipment 38
502.115 Switches, Circuit Breakers, Motor Controllers, and Fuses 38
502.120 Control Transformers 39
502.125 Motors 39
502.130 Luminaires 39
502.140 Flexible Cords 40
502.145 Receptacles and Attachment Plugs 40
502.150 Limited-Energy and Communications Systems 40

ARTICLE 503—CLASS III HAZARDOUS (CLASSIFIED) LOCATIONS 43
Part I. General 43
503.1 Scope 43
503.5 General 43
Part II. Wiring 43
503.10 Wiring Methods 43
503.30 Grounding and Bonding 44
Part III. Equipment 44
503.115 Switches, Circuit Breakers, Motor Controllers, and Fuses 44
503.120 Control Transformers 45
503.125 Motors 45
503.130 Luminaires 45
503.140 Flexible Cords 45
503.145 Receptacles and Attachment Plugs 46

503.150 Limited-Energy and Communications Systems 46

ARTICLE 511—COMMERCIAL GARAGES, REPAIR, AND STORAGE 47
511.1 Scope 47
511.2 Definitions 47
511.3 Classification of Hazardous Areas 47
511.4 Wiring and Equipment in Hazardous (Classified) Locations 50
511.7 Wiring and Equipment Above Hazardous (Classified) Locations 50
511.9 Seals 51
511.10 Special Equipment 51
511.12 GFCI-Protected Receptacles 51

ARTICLE 514—MOTOR FUEL DISPENSING FACILITIES 53
514.1 Scope 53
514.2 Definition 53
514.3 Classification of Locations 53
514.4 Wiring and Equipment Within Class I Locations 54
514.7 Wiring and Equipment Above Class I Locations 54
514.8 Underground Wiring 55
514.9 Raceway Seal 55
514.11 Circuit Disconnect 56
514.13 Maintenance and Service of Dispensing Equipment 56
514.16 Grounding and Bonding 56

ARTICLE 517—HEALTH CARE FACILITIES 59
Part I. General 59
517.1 Scope 59
517.2 Definitions 59
Part II. Wiring and Protection 60
517.10 Applicability 60
517.12 Wiring Methods 60
517.13 Grounding of Equipment in Patient Care Areas 60
517.16 Receptacles With Insulated Grounding Terminals 62
517.18 General Care Areas 62
Part VI. Communications and Signaling Systems 63
517.80 Patient Care Areas 63
517.81 Other-Than-Patient-Care Areas 63

ARTICLE 518—ASSEMBLY OCCUPANCIES 65
518.1 Scope 65
518.2 General Classifications 65
518.3 Other Articles 65
518.4 Wiring Methods 65

ARTICLE 525—CARNIVALS, CIRCUSES, FAIRS, AND SIMILAR EVENTS 67
Part I. General Requirements 67
525.1 Scope 67
525.2 Definitions 67
525.3 Other Articles 67
525.5 Overhead Conductor Clearances 67
525.6 Protection of Electrical Equipment 68
Part II. Power Sources 68
525.10 Services 68
525.11 Multiple Sources of Supply 68
525.20 Wiring Methods 69
525.21 Rides, Tents, and Concessions 70
525.22 Outdoor Portable Distribution or Termination Boxes 70
525.23 GFCI-Protected Receptacles and Equipment 70
Part IV. Grounding and Bonding 70
525.30 Equipment Bonding 70
525.31 Equipment Grounding 71
525.32 Equipment Grounding Conductor Continuity Assurance 71

ARTICLE 547—AGRICULTURAL BUILDINGS 73
547.1 Scope 73
547.2 Definitions 73
547.5 Wiring Methods 73
547.8 Luminaires 75
547.10 Equipotential Planes and Bonding of Equipotential Planes 75

ARTICLE 550—MOBILE HOMES, MANUFACTURED HOMES, AND MOBILE HOME PARKS 77
Part I. General 77
550.1 Scope 77
550.2 Definitions 77
550.4 General Requirements 78
550.13 Receptacle Outlets 78
550.25 AFCI Protection 79
Part III. Services and Feeders 79
550.30 Distribution Systems 79
550.31 Allowable Demand Factors 79
550.32 Disconnect 80
550.33 Feeder 81

ARTICLE 555—MARINAS AND BOATYARDS 83
555.1 Scope 83
555.2 Definitions 83
555.3 Ground-Fault Protection 83
555.5 Transformers 83
555.7 Location of Service Equipment 84
555.9 Electrical Connections 84
555.10 Electrical Equipment Enclosures 84
555.12 Load Calculations for Service and Feeder Conductors 84
555.13 Wiring Methods and Installation 85
555.15 Grounding 86
555.17 Boat Receptacle Disconnecting Means 86
555.19 Receptacles 86

555.21 Motor Fuel Dispensing Stations—Hazardous (Classified) Locations ... 87
555.22 Repair Facilities ... 88

ARTICLE 590—TEMPORARY INSTALLATIONS ... 89
590.1 Scope ... 89
590.2 All Installations ... 89
590.3 Time Constraints ... 89
590.4 General ... 90
590.5 Listing of Decorative Lighting ... 92
590.6 Ground-Fault Protection for Personnel ... 92

PRACTICE QUESTIONS FOR CHAPTER 5—SPECIAL OCCUPANCIES ... 94

CHAPTER 6—SPECIAL EQUIPMENT ... 125

ARTICLE 600—ELECTRIC SIGNS AND OUTLINE LIGHTING ... 127
Part I. General ... 127
600.1 Scope ... 127
600.2 Definitions ... 127
600.3 Listing ... 127
600.4 Markings ... 127
600.5 Branch Circuits ... 128
600.6 Disconnecting Means ... 128
600.7 Grounding and Bonding ... 129
600.9 Location ... 131
600.10 Portable or Mobile Signs ... 131
600.21 Ballasts, Transformers, and Electronic Power Supplies ... 132
600.24 Class 2 Power Sources ... 132
600.33 LED Sign Illumination Systems, Secondary Wiring ... 132

ARTICLE 604—MANUFACTURED WIRING SYSTEMS ... 135
604.1 Scope ... 135
604.2 Definition ... 135
604.4 Uses Permitted ... 136
604.6 Construction ... 136
604.7 Securing and Supporting ... 136

ARTICLE 620—ELEVATORS, ESCALATORS, AND MOVING WALKS ... 139
Part I. General ... 139
620.1 Scope ... 139
Part III. Wiring ... 139
620.23 Branch Circuit for Machine Room/Machinery Space ... 139
620.24 Branch Circuit for Hoistway Pit ... 140
Part IV. Installation of Conductors ... 140
620.37 Wiring in Elevator Hoistways and Machine Rooms ... 140
Part VI. Disconnecting Means and Control ... 140
620.51 Disconnecting Means ... 140
Part VIII. Machine Rooms, Control Rooms, Machinery Spaces, and Control Spaces ... 141
620.85 GFCI-Protected Receptacles ... 141

ARTICLE 625—ELECTRIC VEHICLE CHARGING SYSTEM ... 143
Part I. General ... 144
625.1 Scope ... 144
625.2 Definitions ... 144
625.5 Listed or Labeled ... 144
Part III. Equipment Construction ... 144
625.13 Electric Vehicle Supply Equipment ... 144
625.14 Rating ... 144
625.15 Markings ... 145
Part IV. Control and Protection ... 145
625.21 Overcurrent Protection ... 145
625.23 Disconnecting Means ... 145
625.22 Personnel Protection System ... 145
Part V. Electric Vehicle Supply Equipment Locations ... 145
625.29 Indoor Sites ... 145
625.30 Outdoor Sites ... 146

ARTICLE 640—AUDIO SIGNAL PROCESSING, AMPLIFICATION, AND REPRODUCTION EQUIPMENT ... 147
Part I. General ... 147
640.1 Scope ... 147
640.2 Definitions ... 147
640.3 Locations and Other Articles ... 147
640.4 Protection of Electrical Equipment ... 148
640.6 Mechanical Execution of Work ... 148
640.7 Grounding and Bonding ... 150
640.9 Wiring Methods ... 150
640.10 Audio Systems Near Bodies of Water ... 150
Part II. Permanent Audio System Installations ... 150
640.21 Use of Flexible Cords and Flexible Cables ... 150
640.22 Wiring of Equipment Racks ... 151
640.23 Number of Conductors in a Raceway ... 151
640.25 Loudspeakers in Fire-Resistance-Rated Partitions, Walls, and Ceilings ... 151

ARTICLE 645—INFORMATION TECHNOLOGY EQUIPMENT ... 153
645.1 Scope ... 153
645.2 Definitions ... 153
645.3 Other Articles ... 153
645.4 Information Technology Equipment Room ... 155
645.5 Supply Circuits and Interconnecting Cables ... 155
645.6 Cables Not in Information Technology Equipment Room ... 157
645.7 Penetrations ... 157
645.10 Disconnecting Means ... 157
645.11 Uninterruptible Power Supplies (UPS) ... 158
645.15 Equipment Grounding Conductor ... 158

ARTICLE 680—SWIMMING POOLS, SPAS, HOT TUBS, FOUNTAINS, AND SIMILAR INSTALLATIONS 159
Part I. General Requirements for Pools, Spas, Hot Tubs, and Fountains 159
680.1 Scope 159
680.2 Definitions 159
680.3 Other Articles 160
680.7 Cord-and-Plug-Connected Equipment 160
680.8 Overhead Conductor Clearance 161
680.9 Electric Water Heater 161
680.10 Underground Wiring 162
680.11 Equipment Rooms and Pits 162
680.12 Maintenance Disconnecting Means 162
Part II. Permanently Installed Pools, Outdoor Spas, and Outdoor Hot Tubs 163
680.20 General 163
680.21 Motors 163
680.22 Lighting, Receptacles, and Equipment 164
680.23 Underwater Luminaires 166
680.24 Junction Box, Transformer, or GFCI Enclosure 168
680.25 Feeders 170
680.26 Equipotential Bonding 170
680.27 Specialized Equipment 173
Part III. Storable Swimming Pools 173
680.30 General 173
680.31 Pumps 173
680.32 GFCI-Protected Receptacles 174
680.34 Receptacle Locations 174
Part IV. Spas and Hot Tubs 174
680.40 General 174
680.41 Emergency Switch for Spas and Hot Tubs 174
680.42 Outdoor Installations 174
680.43 Indoor Installations 175
680.44 GFCI Protection 176
Part V. Fountains 177
680.50 General 177
680.51 Luminaires, Submersible Pumps, and Other Submersible Equipment 177
680.53 Bonding 177
680.55 Methods of Equipment Grounding 178
680.56 Cord-and-Plug-Connected Equipment 178
680.57 Signs in or Adjacent to Fountains 178
680.58 GFCI-Protected Receptacles 178
Part VII. Hydromassage Bathtubs 178
680.70 General 178
680.71 GFCI Protection 178
680.72 Other Electrical Equipment 179
680.73 Accessibility 179
680.74 Equipotential Bonding 179

ARTICLE 690—SOLAR PHOTOVOLTAIC (PV) SYSTEMS 181
*This article is covered in *Mike Holt's Illustrated Guide to Understanding NEC Requirements for Solar Photovoltaic Systems*.

ARTICLE 695—FIRE PUMPS 183
695.1 Scope 183
695.3 Power Source(s) 183
695.4 Continuity of Power 184
695.5 Transformers 185
695.6 Power Wiring 185
695.7 Voltage Drop 186
695.14 Control Wiring 186

PRACTICE QUESTIONS FOR CHAPTER 6—SPECIAL EQUIPMENT 188

CHAPTER 7—SPECIAL CONDITIONS 207

ARTICLE 700—EMERGENCY SYSTEMS 209
Part I. General 209
700.1 Scope 209
700.2 Definitions 209
700.3 Tests and Maintenance 210
700.4 Capacity 210
700.5 Transfer Equipment 210
700.7 Signs 211
Part II. Circuit Wiring 211
700.10 Wiring 211
Part III. Sources of Power 212
700.12 General Requirements 212
Part IV. Circuits for Lighting and Power 214
700.15 Loads on Emergency Branch Circuits 214
700.16 Emergency Illumination 214
Part VI. Overcurrent Protection 214
700.25 Accessibility 214
700.26 Ground-Fault Protection of Equipment 214
700.27 Coordination 214

ARTICLE 701—LEGALLY REQUIRED STANDBY SYSTEMS 215
Part I. General 215
701.1 Scope 215
701.2 Definitions 215
701.3 Tests and Maintenance 215
701.4 Capacity and Rating 216
701.5 Transfer Equipment 216
701.7 Signs 216
Part II. Circuit Wiring 216
701.10 Wiring 216

Part III. Sources of Power 216
701.12 General Requirements 216
Part IV. Overcurrent Protection 218
701.25 Accessibility 218
701.26 Ground-Fault Protection of Equipment 218
701.27 Coordination 218

ARTICLE 702—OPTIONAL STANDBY SYSTEMS 219
Part I. General 219
702.1 Scope 219
702.2 Definition 220
702.4 Capacity and Rating 220
702.5 Transfer Equipment 220
702.7 Signs 221
Part II. Circuit Wiring 221
702.10 Wiring 221
702.12 Outdoor Generator Sets 221

ARTICLE 725—REMOTE-CONTROL, SIGNALING, AND POWER-LIMITED CIRCUITS 223
Part I. General 223
725.1 Scope 223
725.2 Definitions 223
725.3 Other Articles 224
725.21 Electrical Equipment Behind Access Panels 226
725.24 Mechanical Execution of Work 226
725.25 Abandoned Cable 227
725.31 Safety-Control Equipment 228
725.35 Circuit Requirements 228
Part II. Class 1 Circuit Requirements 228
725.41 Class 1 Circuit Classifications and Power-Supply Requirements 228
725.43 Class 1 Circuit Overcurrent Protection 228
725.46 Class 1 Circuit Wiring Methods 229
725.48 Conductors of Different Circuits in Same Cable, Cable Tray, Enclosure, or Raceway 229
725.49 Class 1 Circuit Conductors 229
725.51 Number of Conductors in a Raceway 230
Part III. Class 2 and Class 3 Circuit Requirements 230
725.121 Power Sources for Class 2 and Class 3 Circuits 230
725.124 Equipment Marking 230
725.127 Wiring Methods on Supply Side of the Class 2 or Class 3 Power Source 230
725.130 Wiring Methods on Load Side of the Class 2 or Class 3 Power Source 231
725.136 Separation from Power Conductors 231
725.139 Conductors of Different Circuits in Same Cable, Enclosure, Cable Tray, or Raceway 233
725.143 Support 234
725.154 Applications of Class 2 and Class 3 Cables 234
Part VI. Listing Requirements 236
725.179 Listing and Marking Requirements of Class 2 and Class 3 Cables and Raceways 236

ARTICLE 760—FIRE ALARM SYSTEMS 239
Part I. General 239
760.1 Scope 239
760.2 Definitions 239
760.3 Other Articles 240
760.21 Access to Electrical Equipment Behind Panels Designed to Allow Access 241
760.24 Mechanical Execution of Work 241
760.25 Abandoned Cable 242
760.30 Fire Alarm Circuit Identification 243
760.32 Fire Alarm Circuit Cables Extending Beyond a Building 243
760.35 Fire Alarm Circuit Requirements 243
Part III. Power-Limited Fire Alarm (PLFA) Circuits 243
760.121 Power Sources for Power-Limited Fire Alarm Circuits 243
760.124 Equipment Marking 244
760.130 Wiring Methods on Load Side of Power-Limited Fire Alarm Power Source 244
760.136 Separation from Power Conductors 245
760.139 Power-Limited Fire Alarm Circuits, Class 2, Class 3, and Communications Circuits 245
760.143 Support 246
760.154 Applications of Power-Limited Fire Alarm Cables (PLFA) 246
Part IV. Listing Requirements 247
760.179 Listing and Marking Requirements of Power-Limited Fire Alarm Cables (PLFA) 247

ARTICLE 770—OPTICAL FIBER CABLES AND RACEWAYS 249
Part I. General 249
770.1 Scope 249
770.2 Definitions 249
770.3 Other Articles 250
770.12 Innerduct 250
770.21 Access to Electrical Equipment Behind Panels Designed to Allow Access 251
770.24 Mechanical Execution of Work 251
770.25 Abandoned Cable 252
770.26 Spread of Fire or Products of Combustion 252
Part II. Cables Outside and Entering Buildings 253
770.48 Unlisted Cables Entering Buildings 253
Part V. Installation Methods Within Buildings 253
770.110 Raceways for Optical Fiber Cables 253
770.113 Installation of Optical Fiber Cables, Optical Fiber Raceways, and Cable Routing Assemblies 254

770.133 Installation of Optical Fiber Cables 255
770.154 Applications of Optical Fiber Cables and Raceways 256
770.179 Listing and Marking of Optical Fiber Cables 256

PRACTICE QUESTIONS FOR CHAPTER 7—SPECIAL CONDITIONS 257

CHAPTER 8—COMMUNICATIONS SYSTEMS 273

ARTICLE 800—COMMUNICATIONS CIRCUITS 275

Part I. General 276
800.1 Scope 276
800.2 Definitions 276
800.18 Installation of Equipment 277
800.21 Access to Electrical Equipment Behind Panels Designed to Allow Access 277
800.24 Mechanical Execution of Work 277
800.25 Abandoned Cable 278
800.26 Spread of Fire or Products of Combustion 278
PART II. Cables Outside and Entering Buildings 279
800.44 Overhead (Aerial) Communications Cables 279
800.47 Underground Communications Wires and Cables Entering Buildings 279
800.48 Unlisted Cables Entering Buildings 279
800.53 Lightning Conductors 280
Part III. Protection 280
800.90 Primary Protection 280
800.93 Grounding or Interruption of Metallic Sheath Members of Communications Cables 280
Part IV. Grounding Methods 280
800.100 Cable and Primary Protector Bonding and Grounding 280
Part V. Installation Methods Within Buildings 283
800.110 Raceways for Communications Wires and Cables 283
800.113 Installation of Communications Cables and Communications Raceways 284
800.133 Installation of Communications Cables 285
800.154 Applications of Communications Cables and Communications Raceways 286
800.156 Dwelling Unit Communications Outlet 287
Part VI. Listing Requirements 287
800.179 Listing and Marking of Communications Cables 287

ARTICLE 810—RADIO AND TELEVISION EQUIPMENT 289

Part I. General 289
810.1 Scope 289
810.3 Other Articles 290
810.4 Community Television Antenna 290
Part II. Receiving Equipment—Antenna Systems 291
810.12 Support of Lead-In Cables 291
810.13 Avoid Contact with Conductors of Other Systems 291
810.15 Metal Antenna Supports—Grounding 291
810.18 Clearances 291
810.20 Antenna Discharge Unit 292
810.21 Bonding Conductor or Grounding Electrode Conductors 292
Part III. Amateur and Citizen Band Transmitting and Receiving Antenna Systems 296
810.51 Other Sections 296
810.54 Clearance on Building 296
810.57 Antenna Discharge Units 296
810.58 Bonding Conductor or Grounding Electrode Conductors 296

ARTICLE 820—COMMUNITY ANTENNA TELEVISION (CATV) AND RADIO DISTRIBUTION SYSTEMS 297

Part I. General 298
820.1 Scope 298
820.2 Definitions 298
820.3 Locations and Other Articles 298
820.15 Power Limitations 299
820.21 Access to Electrical Equipment Behind Panels Designed to Allow Access 299
820.24 Mechanical Execution of Work 299
820.25 Abandoned Cable 300
820.26 Spread of Fire or Products of Combustion 301
Part II. Coaxial Cables Outside and Entering Buildings 301
820.48 Unlisted Cables and Raceways Entering Building 301
Part III. Protection 302
820.93 Grounding of the Outer Conductive Shield of Coaxial Cables 302
Part IV. Grounding Methods 302
820.100 Bonding and Grounding Methods 302
Part V. Installation Methods Within Buildings 305
820.110 Raceways for Coaxial Cables 305
820.113 Installation of Coaxial Cables 306
820.133 Installation of Coaxial Cables and Equipment 307
820.154 Applications of Coaxial Cables 308
820.179 Listing and Marking of Coaxial Cables 309

PRACTICE QUESTIONS FOR CHAPTER 8—COMMUNICATIONS SYSTEMS 310

FINAL EXAM A QUESTIONS 319

FINAL EXAM B QUESTIONS 330

INDEX 341