

INDEX

A

Alarm Systems, 937–952. See also Fire Alarms

- Auxiliary Protection System, Defined, 937
- Bonding Equipment, 943
- Building Code, 940
- Canadian Electrical Code, 940
- Carbon Monoxide Alarms, 947
- Central System, Defined, 937
- Conductors, 940
- Control Panel Location, 948–950
- Electrical Supervision, 943
- Equipment Bonding, Low Voltage Circuits, 943
- Equipment Bonding, Low Voltage Circuits, Ungrounded
- Electrical Equipment Permissible, 943
- Installation, 939
- Permanently Connected, Installation, 947
- Power Supply, 944–946
- Proprietary Protection System, Defined, 937
- Smoke Alarm Installation, 947
- Standby Power Supply, 946
- Terminology, 937
- ULC Standard, 940
- Wiring Methods, 941
- Wiring Methods, Combustible Buildings, 942–943
- Wiring Methods, Non-Combustible Buildings, 941

Appliances

- Electric Heating and Cooking, 827
- Exceeding 1500 w, 831
- Heavy Appliances, 826–827
- Non-Portable Location, 827
- Supply Connections, 828

Armoured Cables

- Boxes, Running Between, 450
- Concealed, 449
- Continuity, 447
- in Raceways, 445
- Protection in Lanes, 446
- Proximity to Knob and Tube, 449
- Radii of Bends, 449
- Terminating, 447
- Thermoplastic Covered, 447
- Use, 445
- Vertical Runs, 426

B

Bonding. See Grounding and Bonding

Boxes, Securing, 530

Branch Circuits

- Conductor Size, Fixed Heating Systems, 974
- Connections in Residential Units, 976
- Grouping on Single Circuit, 978
- Heating Systems, Non-Residential Units, 977
- Overcurrent Device Rating, 979

Busways and Splitters, 489–502

- AC Circuits, 498

- Branch Circuits, 501–502
- Busway Installation, 491–496, 499–500
- Circuit Restrictions, 503
- Extensions, 498
- Manufacturer Identification, 502
- Plug in Devices, 500–501
- Reduction in Size, 501
- Splitter Boxes, 496–498
- Supports, 498–499
- Taps in Splitters, 502
- Terminal Screws, 498
- Trolley Busway, 491
- Use, 489–490

C

Cabinets, Securing, 530

Cable

- Aluminum-Sheathed, 237
- Copper-Sheathed, 237
- Mineral Insulated, 237
- Supports, 436

Cable Trays

- Ampacities, 515–524
- Bonding, 514–515
- Conductors, 515
- Connection to Other Wiring Methods, 513–514
- Defined, 508
- Hazardous Locations, 508
- Installation, 508–511
- Joints and Splices, 513
- Reduced Clearances, 510

Capacitors

- Conductor Size, 766
- Electrical Equipment, 763, 765
- Grounding, 765
- Motor Circuit Special Provisions, 768
- Stored Charge Draining, 770

Carbon Monoxide Alarms. See Alarm Systems

Circuit Breakers, 594

- Battery Control Power, 596
- Construction, 595
- Non-Tamperable, 595
- Tripping, 596

Circuit Loading and Demand Factors, 255–318

- Apartments and Similar, 303
- Area Determination, 280
- Automobile Heater Receptacles, 318
- Basic Load, Defined, 256
- Branch Circuits, 314–315
- Branch Circuits, Position, 275–282
- Calculated Load, Defined, 256
- Current Calculation, 256
- Data Processing Equipment, 314
- Demonstrated Load, Defined, 256
- Emergency Lighting, 314
- Exit Signs, 314
- Hospitals, 313
- Hotels, Motels, Dormitories, 313–314

Maximum Circuit Loading, 269–272
 Outlets per Circuit, 315
 Schools, 312–313
 Services and Feeders, 281–290
 Show Windows, 314
 Terminology, 256
 Use of Demand Factors, 273–274
 Voltage Drop, 257–269

Circuits

Cycling Loads, 609
 Remote-Control, 607

Circuits, Class 1 and 2, 613–640

Circuits, Communication Cables, 614
 Circuits, Safely Control Devices, 614
 Class 1, 614
 Class 1, Extending Beyond Building, 624
 Class 1, Extra Low Voltage, 613, 620
 Class 1, Installation, 616
 Class 1, Insulated Conductors, 622
 Class 1, Overcurrent Protection, 617, 617–639
 Class 2, 625
 Class 2, Conductors in Ducts and Plenum Chambers, 636
 Class 2, Conductors of Different Class in Same Cable, 636
 Class 2, Conductors - Separation of, 633
 Class 2, Extending Beyond Building, 638
 Class 2, Limitations, 625
 Class 2, Low Energy, 614
 Classification, 613
 Conduction in Vertical Shafts, 636
 Fire Separator, 636
 Hazardous Locations, 614, 614–639
 Limitation of Class 1 Circuits, 614
 Marking, Class 2 Power Supply, 631
 Remote Control, Mechanical Protection, 624
 Underground Installation, 638

Compressed Natural Gas Refuelling Locations

Circuit Disconnects, 725

Conductors, 131–186, 336, 367

Ampacity, Photovoltaic Systems, 1007–1019, 1022
 Ampacity, Wires and Cables, 132–151
 Cables, 413
 Cable Trays, 511
 Class 1 - Insulated, 622
 Class 2 Circuits, 632
 Clearance, 428
 Colour, 182–184
 Common Neutral, 173
 Connections, 380
 Correction Factors, 150
 Different Circuits, 622
 Direct Buried, 403
 Enclosures, Bonding, 337
 Ends, 417
 Equipment Wire, 167
 Flexible Cords, Sizes, 166
 Free Air Space, 147
 Grouping, 147
 Hoistways, 408
 Identification of Insulated Neutral, 176

Identification of Insulated Neutrals Larger than no. 2
 AWG, 177
 Identification of Type MI Neutral, 178
 Identification, Photovoltaic Systems, 1022
 Installation of Neutral, 173–176
 Insulated, 152, 153
 Insulation of Neutral, 167
 Insulation Types, Photovoltaic Systems, 1022
 Joints and Splices, 417
 Locations, 427
 Material and Sizes, 621
 Maximum Current, Aluminum Conductors, 143–152
 Maximum in Box, 544
 Maximum Number, 480
 Minimum Size of Overhead, 428
 Multi-conductor Cables, 150
 Neutral, Unbalanced Current, 144
 Over Buildings, 429
 Parallel, 414
 Parallel Sets, 415
 Portable Power Cables, 184
 Portable Power Cables, Ampacity, 185
 Power Supply, 430
 Raceways, 452
 Radii of Bends, 416
 Sheath Currents in Single, 154–164
 Shielded Cables, 136, 143
 Size, 131
 Size of Neutral, 168
 Sizing, 378
 Splices per, 415
 Stranding, 460
 Support, 425, 427
 Supports, 482
 Temperature Limitations, 152–153
 Terminating at Consumer's Service, 205
 Termination, 418, 419
 Thermoplastic-Insulated, 412
 Trestles, 429
 Types, 411, 427, 452
 Underground Runs, 136–152
 Use of Identified, 179
 Wireways, 504
 Wiring, 411

Conduits

Contraction and Expansion, 472
 Liquid-Tight Flexible, 481–482
 Minimum Size, 469
 PVC, 472
 PVC, Expansion Joints, 478
 PVC, Field Bends, 475
 PVC, Fittings, 476
 PVC, Luminaires Support, 476
 PVC, Mechanical Protection, 475
 PVC Restrictions, 473
 PVC, Support Equipment, 478
 PVC, Supports, 477–554
 PVC, Temperature Limitations, 474
 Rigid and Flexible, 467
 Split Straight Conduit, 480–481

Support Spacing, 470
 Thread Engagement, 470
 Threads, 470

Connections

Circuits and Equipment, 387
 Different Systems, 333
 Dip Service, Mobile Homes, 1053
 Electrodes, 393
 Guy Lines, Mobile Homes, 1058
 Line Clearance, Mobile Homes, 1055
 Mast on Home, Cable Termination in Panel, 1056
 Mast on Home, Cable Type, 1055
 Mast on Home, Grounding, 1056
 Pole Length, Mobile Homes, 1057
 Pole Requirements, Mobile Homes, 1057
 Raceways, 380

Consumer Services, 188

Bare Neutral Conductor, 239
 Condensation in Raceway, 241–254
 Conductors, 233
 Conductors - Location, 225
 Equipment Location, 218
 Equipment, Service Box Enclosure, 218
 Head Location, 207
 Joints, 240
 Joints in Neutral Conductors, 240
 Raceways, 238
 Subdivision, 215
 Underground, 228

D

Deck Boxes

Electrical Continuity, 1036
 Installation Location, 1037
 Installation Requirements, 1036
 Permitted Conductor Types, 1036
 Sealing Gland Thread, 1037
 Terminal, 1036
 Termination Capacity, 1036

Definitions, 88–98

Disconnecting Means

Live Equipment, 124
 Precautions, 124

E

Electrical Code

Definitions, 88–98
 Object, 87
 Scope, 88

Electrical Equipment, 759–838

Auto-Transformers, 784
 Branch Circuits, Arc Fault Protection, 818–819, 823–824
 Branch Circuits, Dwelling Units, 820
 Branch Circuits, Residences, 818
 Branch Circuits, Single Dwelling Unit, 824
 Circuit Breakers, 762
 Circuit Breakers, Indoor, 762
 Combustible Sources, Over, 759

Conductors, Mechanical Protection, 835
 Contactors, Rating for Capacitor Feeders and Branch Circuits, 767
 Cooking Units, Separate Built-In, 827
 Data Processing, 838
 Deep Well Submersible Pumps, 837–838
 Dielectric Heating, 834
 Dielectric Liquid-Filled Equipment, Indoor, 760
 Dielectric Liquid-Filled Equipment, Outdoor, 761
 Disconnecting Means, Capacitor Feeders and Branch Circuits, 767
 Disconnecting Means, Rating, 767
 Electric Pipe Organs, 837
 Fuel Burner Safety Controls, 835
 Fuses, 762
 Fusible Equipment, 763
 Heated Appliances, Signals, 832
 Heating Equipment, 835
 Heating, Greater than 400,000 BTU, 836
 Heating, Rated 400,000 BTU or Less, 835
 Infrared Drying Lamps, 833
 Installation, 759–838
 Installation, Outdoor, 760
 Isolating Switches, 762
 Isolating Switches, Location, 762
 Outlets, Carports, 816–817
 Outlets, Garage Plug, 818
 Overcurrent Protection, 766
 Overcurrent Protection, Instrument Voltage Transformers, 784
 Overcurrent Protection, Power and Distribution Transformers Rated 750 v or Less, 776
 Panelboards, 785
 Panelboards, Dwelling Units, 785
 Panelboards, Location, 788
 Pipe Organs, 837
 Sprinklered Equipment, 759
 Storage Tank Water Heaters, 832
 Submersible Pumps, 837–838
 Supply Feeder to Panel, 789
 Terminal Connections, 759
 Ventilated Enclosures, 759
 Ventilation Control, Cooking Equipment, 834
 Water Heaters, 834
 Zero Sequence Filters, 784

Electric Lighting

Basements, Coverage, 921
 Basements, Unfinished, 921
 Branch Circuits, Capacity, 928
 Branch Circuits, Conductors - Temperature Rating, 933
 Ceiling Outlet Boxes, Branch Circuit Insulation, 918
 Ceiling Outlet Box Wiring, Ampacity, 919
 Circuit Breakers for 100 v or Less, 927–936
 Circuit Connections, Inspecting, 907–936
 Commercial Fuse or Breaker Rating, 898–936
 Commercial Lampholders, Fibre Lining, 902–936
 Commercial Lighting Track, 898–936
 Conductors, Insulation Heat Rating, 933
 Connection Box above Fixtures, Inspecting, 908–936
 Contactors, 1000 v or Less, 927–936

Crawl Space, Preventing Mechanical Injury, 913
 Damp Locations, CSA Markings, 914
 Discharge Lighting, Greater than 1000 v, 928
 Electric Discharge Lighting Systems, 1000 v or Less, 923
 Fixed Box Access, from Above, 934
 Fixed Box Access, from Below, 934
 Fixtures as Raceways, 910–912
 Fluorescent, Installation on T-Bar, 906–936
 Garages and Carports, Control Switch Placement, 921
 Garages and Carports, Near Dwelling Entrance, 921
 HID Lamps, 923–936
 HID Lamps, Ballast Enclosures, 925–936
 Industrial Fuse or Breaker Rating, 898–936
 Industrial Lighting Track, 898–936
 Lampholder, vs. Light Fixture, 922
 Lampholder, Weatherproof, 923
 Lamp Socket Installation, 901–936
 Light Fixture vs. Lampholder, 922
 Lighting Branch, Aggregate Capacity, 928–936
 Location, 901
 Mechanical Injury, Preventing, 913
 Outlets, in Closets, 904–936
 Outlets, Wall Switch, 915
 Polarization, Electric Discharge Lighting, 900–936
 Polarization, Incandescent Lamps, 900–936
 Portable Showcase, 904–936
 Showcase, 903–936
 Stairwell Control Switches, 921
 Switches for 1000 v or Less, 926–936
 Tap Connection Conductors, Example, 919
 Tap Connection Conductors, Heat Rating, 933
 Ungroundable Equipment, 901–936
 Ungrounded Supply, 900–936
 Weatherproof Lampholder, 923
 Wiring, 917
 Wiring, Color Coded, 918–936

Electric Welders, 953–960

Actual Primary Current, Defined, 953
 Attachment Plugs, 954
 Duty Cycle, Defined, 953
 Motor-Generator Type, 957
 Receptacles, 954
 Resistance Type, Control of, 959
 Resistance Type, Nameplate Data, 959
 Resistance Type, Overcurrent Protection, 959
 Resistance Type, Supply Conductors, 958–959
 Resistance Type, vs. Transformer Arc Type, 959
 Resistance Welder Type, 958
 Terminology, 953
 Transform Arc Type, 954
 Transform Arc Type, Conductor- Group of Welders, 954–959
 Transform Arc Type, Conductors - Individual Welder, 954–959
 Transform Arc Type, Disconnecting Means - Location, 957–959
 Transform Arc Type, Disconnecting Means - Type, 957–959
 Transform Arc Type, Low Operating Duty Cycle, 955–959
 Transform Arc Type, Overcurrent Device Protection

Maximum Rating, 957–959
 Transform Arc Type, Overcurrent Protection, 955–959
 Transform Arc Type, Supply Conductors, 954
 Transformer Arc Type, vs. Resistance Type, 959

Emergency Systems, 961–968

Capacity, 962
 Equipment, 965–968
 Equipment Mounting, 965
 Exit Signs, 966–967
 Lamp Location, 962
 Life Safety Systems, Defined, 961
 Maintenance, 962
 Operating Instructions, 962
 Power Supply, 962, 963, 964
 Power Systems, Trouble Signalling Devices, 965
 Remote Lamps, 965, 966
 Supply Connections, 966
 Terminology, 961–962
 Wiring Method, 962

Exit Signs. See **Emergency Systems**

F

Fire Alarms, 940–949. See also **Alarm Systems**

Classification, 938–939
 Conductors, Minimum Size, 940
 Conductors, Rating, 940
 Conductors, Sizing, 940
 Conductors, Solid, 940
 Conductors, Stranded, 940
 Conductors, Suitable for Purpose, 941
 Current Supply, Point of Connection Compliance, 945
 Current Supply, Public Electrical Supply Utility, 944
 Disconnecting Means - Circuit Breaker Rating, 950
 Disconnecting Means - Labelling, 950
 Disconnecting Means - Lockable, 950
 Disconnecting Means - Transfer Switch, 950
 Installation, 941, 942
 Local Station, Defined, 937
 Optical Fiber Cables, 940
 Point of Connection, 944
 Required, 937
 Secondary Source of Power, 946
 Separation, 942–943
 Type 1, 938
 Type 2, 938
 Type 3, 938
 Type 4, 939
 Type 5, 939
 ULC Standards, 948

Fire Pumps, 950–951. See also **Alarm Systems**

Conductors, 950
 Disconnecting Means, 950
 Ground Fault Protection, 951
 Overload Protection, 951
 Service Box, 950
 Transfer Switch, 950
 Wiring Method, 950

Fitting Supports, 530

Fixed Heating Systems, 969–1006

Adjacent Combustible Materials, 975, 999
 Ampacity for Service, Feeder, Branch Conductors, 980
 Application, 969
 Bare Element Water Heater, 1006
 Bare Element Water Heater, Defined, 970
 Bonding to Ground, 969, 994
 Branch Circuits, 974–975
 Breaker Sizing, 981
 Buried, Terminal Box, 972
 Central Unit, Defined, 970
 Central Unit, Installation, 991
 Concrete, Asphalt Heating, 969
 Conductor and Circuit Breaker Size for Fixed-Resistance Electrical Supplies, 980
 Connections, Conductor and Unit, 972–973
 Definitions, 969–971
 Demand Factors, 986
 Dielectric Heating, 971
 Dielectric Heating, Defined, 970
 Disconnection Switches, 992
 Drapery Clearance, 976
 Electric Space Heating, 989–998
 Electric Surface Heating Systems, 999–1003
 Electric Surface Heating Systems, Combustibles, 999
 Electric Surface Heating Systems, Driveways, 999
 Furnace Supply Cable, 991–992
 Ground Fault Protection, 981–982
 Hazardous Locations, 971
 Heating and Venting Combination Unit, 974
 Heating Device, Defined, 970
 Heat Lamps, Interpretation, 975
 Impedance Heating, 971
 Impedance Heating, Defined, 970
 Induction Heating, 971, 1005
 Induction Heating, Defined, 970
 Infrared Radiant Heaters, 970, 1005
 Infrared Radiant Heaters, Metal-Sheath Element, 997–998
 Installation, 969, 999
 Installation of Electric Surface Heating Fixtures, 999
 Load Rating for Branch Circuit Supply, 979
 Luminaires, Secondary Heat Source, 974, 1005
 Markings, Infrared Radiant Heaters, 970
 Mechanical Protection, 993
 Non-heating Leads of Heating Device Sets, 988–989
 Overcurrent Protection and Grouping, 976–981
 Overcurrent Protection, Storage-tank Water Heaters, 1005
 Pipeline Impedance Heating, 1004–1005
 Proximity to Other Wiring, 990
 Radiant Heating Panels, Location, 994
 Sauna Heater, 998
 Sauna Heater, Defined, 971
 Sauna Heater, Installation, 998
 Skin Effect Trace Heating, 971
 Skin Effect Trace Heating, Defined, 971
 Skin Effect Trace Heating, Installation, 1003
 Storage-tank Water Heaters, Overcurrent Protection, 1005
 Supply Cable to Furnace, 991–992
 Temperature Control Devices, 986
 Temperature Controls for Space Heating, 989

Temperature, Exceeding 150 degrees, 995
 Terminal Box Material, 972
 Terminal Connections, 972–974
 Terminal Connections, Cable Entry, 972
 Terminal Connections, Double Cable Entry, 972
 Terminology, 969–971
 Wattage, Heating Panels, 994

Fixtures, Heating

as Raceways, 995
 as Wireways, 995
 Defined, 970
 Electric Baseboard Heaters, 970
 Installation, 975–976, 995
 Installation, Exposed to Damage from Flying Objects, 995
 Installation, Greater than 4.5 kg, 995
 Installation, Greater than 23 kg, 995
 Installation, Less than 13 kg, 995
 Installation, Less than 23 kg, 995
 Terminal Connections, 972–973

Flame Spread Requirements. See General Rules**Flammable Industrial Locations, 701–758**

Commercial Repair Garages, 726
 Compressed Natural Gas, 718–725
 Gasoline Dispensing and Service Stations, 701

Flexible Cords

Ampacity, 167
 Hazardous Locations, Zone 1, 678
 Hazardous Locations, Zone 2, 691
 Hazardous Locations, Zone 20, 696
 Show Windows, 167
 Uses, 164

Fuses

Fuse Holders, 582–583
 Non-Interchangeable, 582
 Rating, 582
 Time Delay and Low Melting Point, 580
 Uses, 583

G**Gasoline Dispensing and Service Stations**

Bonding, 713
 Hazardous Areas, 701
 Sealing, 711
 Wiring Equipment, 716
 Wiring Equipment Above Hazardous Areas, 710
 Wiring Equipment in Hazardous Areas, 709

General Rules, 99–130

Accessibility for Maintenance, 128
 Application for Inspection, 99
 Approved Equipment Use, 102
 Authority, 99
 Availability of Work for Inspection, 106
 Circuit Voltage-to-Ground-Dwelling Units, 109–110
 Conductors, Sizes, 111
 Corrosion Protection, 111
 Current Permits, 100
 Damage and Interference, 106
 Deviation of Postponement, 106

- Disconnection, 124
- Drainage, 129
- Electrical Equipment, Combustible Gas Meters, 129
- Electrical Equipment, Installation, 111
- Electrical Equipment, Ratings, 108
- Electrical Equipment, Rebuilt, 108–109
- Electrical Equipment, Substitution, 109
- Enclosures, Marking, 130
- Enclosures, Type Designation and Use, 129
- Entrance, Exit from Working Space, 126
- Fees, 100
- Fire Spread, 113
- Flame Spread Requirements, 115, 120–126
- Flammable Material near Electrical Equipment, 129
- GFCIs, Class A, 121–122
- Guarding Bare Live Parts, 123
- Illumination of Equipment, 128
- Insulation Integrity, 121
- Maintenance, 123
- Maintenance, Hazardous Locations, 123
- Marking Equipment, 106
- Masonry and Concrete, Anchoring, 110
- Motors, Marking, 130
- Non-Electrical Equipment, Installation, 112
- Permits, 99
- Permits, Posting, 100
- Plans and Specifications, 100
- Powers of Rejection, 105
- Protection of Persons and Property, 122
- Quality of Work, 110
- Rebuilt Equipment, 108–109
- Receptacles, maintenance of equipment, 128
- Reconnection, 100
- Reinspection, 101
- Renovation of Existing Installations, 101
- Shock and Flash Protection, 124
- Soldering Fluxes, 111
- Special Requirements, 99
- Sunlight Resistance, 121
- Thermal Insulation, 112
- Ventilation, 129
- Warning and Caution Markers, 108
- Working Space, Access and Egress, 126
- Working Space around Electrical Equipment, 124

Generators

- 3-Wire Direct Current, 896
- Disconnecting Means, 895
- not Electric-Driven, 896
- Protection and Control, 895

GFCIs

- Pools, Tubs, Spas, 1041–1042
- Type A, 121

Ground Fault Detection

- Ungrounded Supply, 322–323

Grounding

- Circuits Less than 50 v, 1026
- Conductor Sizing, 1026
- Deck Box, 1034
- Direct-Current System, 1026

- Diving Board Supports, 1033
- Electrodes, 1027
- Forming Shells, 1034
- Interpretation of Rule, 1033
- Ladders, Slides, Guardrails, 1033
- Luminaire and Lighting Equipment, 1034
- Metal Fences, 1033
- Piping, 1033
- PVC Conduit, 1034
- Reinforcing Steel, 1033
- Requirements, 1033
- Single Steel Cable, 1033
- Steel Jacketed Pools, 1033
- Three-Wire, Direct-Current, 1026
- Two or More Structures from a Single Service, 1027
- Two-Wire Direct-Current System, 1026
- Underwater Speakers, 1034

Grounding and Bonding, 319–396

- Alternating Current, 322, 325
- Alternating Current, Ground Fault Detective Device, 323
- Cases of Instruments, Meters, Relays, 346
- Circuits, 320
- Clean Surfaces, 347
- Common Conductors, 347
- Common Electrodes, 347
- Continuity, 348, 367
- Current Over, 324
- Direct Current, 325
- Effective, 346
- Electric Arc Furnace Currents, 323
- Electric Crane Circuits, 323
- Electrodes, 357
- Enclosures for Service Conductors, 337
- Equipment, 339
- Fixed Equipment, 339, 354
- Fixed Equipment, Specific, 340
- Grounded Circuit Conductor, 355
- Grounding Conductor Connection to Grounding Electrodes, 381
- Installation, 369, 371
- Isolated Circuits, 323
- Jumpers, 352
- Livestock Housing, 334–336, 340, 345
- Loosely Jointed Metal Raceways, 351
- Manufactured Electrodes, 357
- Material, Bonding Conductors, 367–369
- Material, Grounding Conductors, 319, 367
- Maximum Volts to Ground, Commercial, 320
- Maximum Volts to Ground, Dwelling Units, 320
- Methods, 346, 347
- Non-Current Carrying Metal Parts, 356
- Non-Electrical Equipment, 342
- Non-metal Wiring, 340
- Other Conductor Enclosures, 338
- Other than Service Equipment, 350
- Outline Lighting, 380
- Paralleled Circuit Conductors, 379–387
- Pendant Equipment, 355
- Photovoltaic Systems, 375–387
- Portable Equipment, 345, 355

Raceways, Short Section, 353
 Railway Track, 364
 Return Path, 320
 Service Cable, 350
 Service Equipment, 348
 Size for AC, 376
 Size for Circuits to Portable, Pendant, Fixed Equipment, 380
 Size for DC, 375
 Size for Instrument Transformers, 380
 Spacing and Interconnection, 364
 Systems and Circuits, 320, 324
 Three-Wire Direct-Current, 321
 Two or More Buildings, 334–336
 Underground Service, 337
 Ungrounded Systems, 337
 Water Heaters, Electrolytic, 356

H

Hazardous Locations, 641–700

Adequate Ventilation, Defined, 642, 647
 Approved vs. Suitable, 641
 Bonding, 661
 Cable Gland, Defined, 642–643
 Cable Seal, Defined, 642
 Cable Trays in Dust Atmospheres, 660
 Classification, Class/Division system, 641–642
 Classification, IEC Zone system, 641–642, 646–650, 692
 Classification, Reasons for Hazard, 644
 Combustible Dust, Defined, 643, 650–651, 692
 Combustible Flyings, Defined, 643, 650–651, 692
 Combustible Gas Detection, 660–661
 Conduit Seal, Defined, 643
 Degree of Protection, Defined, 643
 Equipment Protection Level, Defined, 643
 Equipment Rooms, 659
 Equipment, General, 652–654
 Equipment, Zone 0, 662–663
 Equipment, Zone 2, 679
 Explosive Atmosphere, 651–652
 Explosive Atmosphere, Defined, 644
 Explosive Dust Atmospheres, 692–700
 Explosive Gas Atmospheres, 662–691
 Explosive Limits, Defined, 644
 Flammable Fluid Seals, 661
 Flexible Cords, Zone 1, 678
 Flexible Cords, Zone 2, 691
 Flexible Cords, Zone 20, 696
 Fluids, Defined, 660
 Installations, Zone 0, 662–663
 Installations, Zone 1, 663–678
 Installations, Zone 2, 679–691
 Installations, Zone 20, 692–696
 Installations, Zone 21, 697
 Installations, Zone 22, 697–698
 Intrinsically Safe Equipment and Wiring, 660–661
 Luminaires, Zone 1, 676–678
 Luminaires, Zone 2, 689–691
 Maintenance, 652

Marking, 654–658
 Metal-Covered Cable, 659
 Non-incendive systems, 660–661
 Pressurized Equipment or Rooms, 660
 Rooms, Sections, or Areas, 659
 Temperature, 658
 Temperature and Gas Groups, 653–654
 Terminology, 642–646
 Type of Protection, Defined, 645
 Uninsulated Exposed Parts, 661
 Zone 0, 645, 646–649, 662–663
 Zone 1, 645, 646–649, 663–678
 Zone 2, 645, 649–650, 679–690
 Zone 20, 646, 650–652, 692–694
 Zone 21, 646, 650–652, 697
 Zone 22, 646, 650–652, 697–699

Heating Cable Sets

Defined, 970
 Installation, 996–997
 Installation, Pipes, Ducts, or Vessels, 1003
 Installed or Wrapped around Surfaces, 1002
 Usage Markings, 1004

Heating Panels. See also Fixed Heating Systems

Caution Labels, 1002
 Contact with Thermal Insulation, 994
 Defined, 970
 Installation, 996–997
 Installed on Industrial Tanks, Vessels, Pipes, 1002
 Location, 994
 Securing, 996
 Wattage, 994

Heating Systems, Other, 1003–1006

Hot Tubs

Area Lighting, 1048
 Bonding to Ground, 1046
 Breaker Size, 1048
 Controls - Location, 1047
 GFCI Protection, 1046
 Outlets, 1048

Hydromassage Tubs

Controls, 1044
 Cord-Connected, 1045
 Disconnect Switches, 1044
 GFCI, 1044
 Motor Access, 1044
 Motor Controls, 1044
 Other Equipment, 1046
 Receptacle for Cord, 1045
 Timer Location, 1045

I

Instrument Transformers

Cases, 346
 Circuits, 324

J

Junction Boxes, Pools, Spas, Tubs, 1036–1037

L**Life Safety Systems.** See **Emergency Systems****Lighting Equipment**

Auxiliary Equipment, 924
 Basements, 921
 Bonding, 901
 Cabinet Lighting Systems, Defined, 897
 Cable Lighting Systems, Defined, 897
 Ceiling Outlet Boxes, Wiring, 918
 Circuit Connections, 907
 Clothes Closets, 904
 Colour Coding, 918
 Combustible Shades and Enclosures, 912
 Conductors, Insulation, 918
 Conductors, on Movable Parts, 918
 Controls, 926, 928
 Damp Locations, 914
 Direct-Current, 924
 Discharge Lightning Less than 1,000 v, 923
 Discharge Systems More than 1000 v, 928
 Entrances of Residential Dwellings, 920
 Garages and Carports, 921
 Installation, 897–936
 Lampholders, Connections, 922
 Lampholders, in Damp Locations, 922
 Lamp Supports, 929
 Lamp Terminals and Lampholders, 929
 Landscape Lighting System, Defined, 897
 Live Parts, 904
 Luminaires, as Raceways, 910
 Luminaires, Damp Locations, 914
 Luminaires, Designed for Non-Combustible Surface Contact, 933
 Luminaires, Designed for Thermal Insulation Contact, 933
 Luminaires, Gasketed and Enclosed, 916
 Luminaires, in Dwelling Units, 920
 Luminaires, Minimum Height, 913
 Luminaires, Protection from Flying Objects, 913
 Luminaires, Recessed, 930–936
 Luminaires, Show Window - Wiring, 919
 Luminaires, Spacing - Non-IC Marked Spacing Type, 932
 Luminaires, Spacing - Non IC Type, 931
 Luminaires, Wiring, 917
 Luminaires, Wiring Recessed, 933
 Marking, 930
 Near Grounded Metal, 914
 Near or Overcombustible Material, 901
 Outlet Boxes Covered, 907
 Overcurrent Devices, 898–936
 Overcurrent Protection, High-Intensity Discharge, 899
 Pendant Lampholders, 923
 Polarization of Luminaires, 899
 Protection, 898
 Recessed Luminaires, Defined, 897
 Recessed Luminaires, Type Non-IC - Defined, 897
 Recessed Luminaries, Type IC - Defined, 897
 Residential Fuse or Breaker Rating, 898–936
 Show Windows, 902–903
 Stairways, 921

Storage Rooms, 921
 Supports, 904–906
 Supports, Luminaires Less than 13 kg, 905
 Supports, Rigid PVC Boxes, 906
 Switched Lampholder on Unidentified Circuits, 922
 Switched Lampholders with Pull-Strings, 922–936
 Terminology, 897
 Top Connection Conductor, 919
 Transformer, Secondary Connection, 929
 Transformers, Liquid-Filled, 929
 Transformers, Loading, 929
 Transformers, Location, 929
 Transformers, Oil-Filled, 924
 Transformers, Ratings, 929
 Undercabinet Lighting, Defined, 897
 Voltage, 897
 Voltage, Commercial and Industrial, 898–936
 Voltage, Dwelling Units, 897–936, 924, 928
 Voltage, Fluorescent, 898–936
 Voltage, Incandescent, 898–936
 Voltage, Non-Dwelling Units, 897–936
 Wiring Method, 929
 Wiring Space, 907

Lightning Arresters

Installation, 395
 Secondary Services, 394–395
 Uses, 364

Luminaires

Combustible Material, Control Switch, 901–936
 Contact with Water, 1040
 Dry-Niche - Pools, Tubs, Spas, 1041
 Electrical Protection - Pools, Tubs, Spas, 1040
 Electric Discharge Polarization, 900–936
 Floating Box Type, 935
 Hazardous Locations, Zone 1, 676
 Hazardous Locations, Zone 2, 689–691
 Incandescent Polarization, 900–936
 Installed in Low-Ceiling Basement, 913
 Pools, Tubs, Spas, 1039
 Preventing Mechanical Injury, 913
 Recessed, Electric Lighting, 930
 Recessed, Fluorescent Wiring, 936
 Recessed, Heat-Sensing, 933
 Recessed, Lamp Wattage Rating, 930
 Recessed, Light Fixtures, Connection or Terminal Boxes, 931
 Recessed, Minimum Distance, 932
 Show Window Junction Box, 919
 Standards and Support Installation - Pools, Tubs, Spas, 1040
 Submersible and Wet-Niche - Pools, Tubs, Spas, 1039
 Supply Accessibility, 935
 Wet-Niche and Forming Shells - Pools, Tubs, Spas, 1040–1041

M**Marking**

Certification, Photovoltaic Systems, 1014
 Hazardous Locations, Photovoltaic Systems, 1008, 1014

Photovoltaic Systems, 1012, 1013, 1014
 Power Conditioning Units, 1014
 Requirements, Photovoltaic Systems, 1014
 User, Photovoltaic Systems, 1014

Meters

Disconnecting, 252
 Impedance, 254
 Location, 253
 Loops, 243
 Space Required, 254

Mobile Homes, 1051–1062

Cable Connectors, 1060
 Conductors, Minimum Ampacity, 1051
 Connection Boxes, 1060
 Connection Facilities, 1061
 Connection Methods, 1053
 Connection Methods, Mast on Home, 1054
 Consultation, 1053
 CSA Markings, 1051
 Demand Factors, 1051
 Disconnecting Means, Recreational Vehicles, 1059
 Driveway Crossing, 1057
 Feeders, Minimum Ampacity, 1051–1059
 Feeders, Permissions, 1059
 Overcurrent Devices, 1059, 1061
 Overcurrent Devices, Amp Rating, 1060
 Overcurrent Devices, Recreational Vehicles, 1059
 Placement, 1053
 Pole Location, 1056
 Pole Service, 1055
 Power Supply Cords, 1061
 Private Property, 1052
 Road Crossing, 1056
 Roof Crossing, 1057
 Service Equipment, 1051
 Services and Distribution, 1051–1061
 Service Size, Example, 1052
 Supply Cords, Special Permissions, 1059
 Utilities, Notification, 1053

Motors

Conductors, Ampacity, 886
 Conductors, Individual Motors, 844
 Conductors, Insulation - Rating and Ampacity, 841
 Conductors, Multiple Motors, 846
 Conductors, Sizes, 891
 Continuous Duty, 839–896, 845
 FLA - Determining, 845
 Grouping on Single Branch Circuit, 856

Motors and Generators, 839–896

Automatic Restart, Following Overload, 865
 Balancer Sets, 896
 Branch Circuit Ampacity, Non-Continuous Duty Service, 846
 Circuit Breakers, Instantaneous Trip, 861
 Constant Voltage Protection, 895
 Control Circuits, Grounded, 872
 Control Equipment, 887
 Control Locations, 871
 Control, Part-Winding Starters, 870

Control Required, 867
 Controls, 867, 894
 Controls, Large Motors, 869
 Controls, Ungrounded Systems, 873
 Disconnecting Means, 876, 888, 895
 Disconnecting Means, Heating and AC Units, 877
 Disconnecting Means, Location, 878
 Disconnecting Means, Types and Ratings, 876
 Enclosed Fan-Cooled Motor, 843
 Enclosed Non-Ventilated Motor, 843
 Feeder Conductors, 853
 Fuseholder, Size, 859
 Guarding, 840
 Hermetic Refrigerant Motor Compressor, Defined, 839
 Hermetic Refrigerant Motor Compressors, 884
 Horsepower Rated Equipment, 885
 Locked Rotor Current Rating, Defined, 839
 Marking, 884
 Methods of Guarding, 840
 Non-Continuous Duty, Motor, Defined, 839
 Non-Continuous Duty, Service, Defined, 839
 Open Motor, 842
 Permanent Connection, 891
 Portable Motors, 841
 Rated Load Current, Defined, 839
 Secondary Conductors, 854
 Service Factor, Defined, 839
 Starters, Different Start and Run Positions, 872
 Stationary Motors, 841
 Tap Conductor Ampacity, Individual Motors, 846
 Terminology, 839
 Undervoltage Protection, 866
 Ventilation, 840–841
 Winding Motors, 889
 Winding Motors, Usage, 890
 Wiring Methods and Conductors, 841

O

Object, Scope, and Definitions of Electrical Code, 87–98

Overcurrent Devices

Class 1, 617
 Class 2, 631
 Enclosure, 580
 Enclosures, 543
 Equipment in Load Side, 637
 Installation, 630
 Location, 631
 Location, Class 1 Circuits, 620
 Panelboard, 607
 Parallel, 580
 Placement, 596
 Rating, 580
 Required, 560–561

Overcurrent Protection

Motors and Generators, 854, 887, 893
 Motors and Generators, Branch Circuits, 854
 Motors and Generators, Dual Element Fuses, 855
 Motors and Generators, Feeders, 855

Motors and Generators, Fire Pump Motors, 864
 Motors and Generators, Full-Load Circuits, 855
 Motors and Generators, Low Voltage, 867
 Motors and Generators, Low Voltage Release, 867
 Motors and Generators, Markings, 855
 Motors and Generators, Motors Larger than 1 hp, 864
 Motors and Generators, Self-protected Motor Controller, 854
 Motors and Generators, Semiconductor Fuses, 861
 Motors and Generators, Service Factor Application, 863
 Motors and Generators, Undervoltage Protection on Feeders, 867

Overheating Protection

Motors and Generators, 861–866, 865, 866
 Motors and Generators, Required, 865

Overload Protection

Maximum % of Motor FLA, 863
 Motors and Generators, 861, 863, 887, 894
 Motors and Generators, Shunting During Startup, 865
 Number and Location, 862
 Rating, Motors and Generators, 862
 Trip Selection, 862

P

Parallel Heating Cable

Defined, 970
 Nonmetallic Pipes, Ducts, or Vessels, 1002

Photovoltaic Systems, 1007–1028

AC Module, Defined, 1008
 Additional Information, 1022
 Array, Defined, 1008
 Attachment Plugs, 1018
 Battery Enclosure, Ventilation, 1027
 Bipolar Systems, 1008, 1010
 Bonding, 1012, 1027–1028
 Bonding Methods, 1027
 Bonding Modules, 1018
 Branch Circuit Wiring, 1022
 Certification Marking, Obtaining, 1014
 Charge Controller, Defined, 1008
 Charger Controller, Defined, 1008
 Circuit Breakers and Fuses, 1022
 Circuit Loading, 1022
 Class 1 Circuits, 1007–1019
 Class 2 Circuits, 1007–1019
 Classification, 1007–1019
 Common Return Conductor, 1009
 Conductors of Different Systems, 1009
 Disconnecting Means, 1010–1011, 1018
 Feeder and Branch Circuits, 1022
 Grounding, 375, 1012–1013, 1026–1028
 Hazardous Location Compliance, 1008
 Installation, 1007
 Interconnections to Other Circuits, 1013
 Inverter Voltage, 1007–1019
 Loss of Interactive System Power, 1013–1014
 Marking, 1012, 1014, 1016
 Module, Connection, 1018
 Monopole, Defined, 1008

Operating Rating vs. Voltage Rating, 1015
 Output Circuit, Defined, 1008
 Overcurrent Protection, 1010, 1017, 1017–1018
 Overcurrent Protection, Device Accessibility, 1017
 Panel, Defined, 1008
 Parallel Conductors, 1022
 Photovoltaic Combiner, Defined, 1008
 Photovoltaic Module, Defined, 1008
 Point of Common Coupling, Defined, 1008
 Power Conditioning Unit, Defined, 1009
 Power Conditioning Unit, Output Circuit, Defined, 1009
 Power Source, Defined, 1008
 Public Access, 1015
 Rapid Shutdown Device, 1014, 1018
 Residential Units, Load Calculation, 1022–1023
 Solar Cell, Defined, 1009
 Solar Photovoltaic System, Defined, 1009
 Source Circuit, Defined, 1008
 Stand-Alone System, Defined, 1009
 Supply Conductor, Defined, 1009
 System Grounding, 1011–1012
 Terminology, 1008–1009
 Ungrounded Systems, 1012, 1027
 Ventilation, Battery Enclosure, 1027
 Voltage Drop, 1015, 1023–1028
 Voltage Drop Tables, 1024
 Voltage Ratings, 1014, 1014–1015
 Voltage Rating vs. Operating Rating, 1015
 Windcharger System Combination, 1027
 Wiring Methods, 1011, 1016–1017

Pools, Tubs, Spas, 1029–1050

Bonding Conductors, 1032
 Bonding Conductors, Size, 1033
 Bonding Conductors, Termination of, 1035
 Bonding Connections, 1035
 Bonding, Continuous Metal Pool, 1033
 Bonding, Fibre Glass or Wood Staves, 1047
 Bonding, from Junction Box, 1033
 Bonding Medium, 1032
 Bonding, Metal Parts and Non-Electrical Equipment, 1032
 Bonding, Reinforcing Steel, 1032
 Bonding, to Ground, 1032
 Conductors, Communication, 1030
 Conductors, Other, 1030
 Conductors, Size, 1048
 Controls and Other Equipment, 1047
 Electrical Supply, 1048
 Electrical Supply, Motor Load, 1048
 Equipment in Walls or Water, 1030
 Field-Assembled Units, 1049
 GFCIs, 1041–1043
 Hydromassage Bathtubs, 1044–1045
 Installation, 1046
 Leakage Current Collectors, 1048
 Lighting, 1040
 Other Conductors, 1030
 Other Electrical Equipment, 1043
 Overhead, High Voltage Lines, 1030
 Overhead Lines, 1030–1031
 Overhead Wiring, 1030

Permanently Installed Pools, 1043
 Pumps, 1043–1044
 Receptacles, 1039
 Receptacles, Ground Fault Circuit Interrupter, 1039
 Receptacles, Placement, 1039
 Requirements, 1029
 Spas, Area Lighting, 1048
 Spas, Plug Outlets, 1048
 Storable Swimming Pools, 1043
 Terminology, 1029
 Underground Wiring, 1031
 Wiring, 1030–1031

Protection and Control, 555–612

Connection of Devices, 560
 Connections, 597
 Control Devices, 596
 Control Devices, Unnecessary, 604
 Devices, 560
 Devices, Rating, 596
 Disconnecting Means, 596
 Enclosure, 597
 Ground Fault Protection, 569
 Grouping, 597
 Knife Switches, Mounting, 600
 Location and Grouping, 580
 Miscellaneous Apparatus, 604
 Outlet Control, Multiple Points, 604
 Placement, 597
 Plug Fuses, 581
 Position Indicators, 597
 Protective Devices, Distribution Centre, 580
 Ratings, 557
 Receptacles, Protection, 604
 Series Rated Combinations, 560
 Solid State Devices, 611
 Supplementary Protectors, 580
 Transfer Equipment, 609

PVC. See **Conduits**

R

Raceways

Capping Unused, 467
 Concrete Installation, 466
 Conductors in Conduit and Tubing, 457–460
 Conductors, Inserting, 457
 Conductors, Protecting, 456
 Electrical Continuity, 460
 Fins and Burrs Removal, 462
 Installed before Conductors, 466
 Junction of Open Wiring, 463
 Maximum Bends, 467
 Mechanical Continuity, 462
 Metal, 467
 Metal in Plaster, 465
 Protection in Lanes, 465
 Radii of Bends, 462
 Rules, 452
 Support, 462
 Underground Moisture Accumulation, 464

Receptacles

Child Care Facilities, 799
 Electrical Equipment, 796
 Equipment Maintenance, 128
 Residences, 801–816
 Weather Exposure, 799–801

Recreational Vehicle Parks. See **Mobile Homes**

Renewable Energy Systems. See **Photovoltaic Systems**

S

Sealing

Hazardous Locations, Zone 0, 662
 Hazardous Locations, Zone 1, 667
 Hazardous Locations, Zone 2, 683
 Hazardous Locations, Zone 20, 694
 Hazardous Locations, Zone 21, 697
 Hazardous Locations, Zone 22, 699

Series Heating Cable

Construction, 987
 Defined, 971
 Distance from Heat Producing Equipment, 987
 Installation, 987
 Repair, Modification, Assembly, 988

Service Conductors

Ampacity, Combined Loads, 982–986
 Ampacity, Residential Thermostatic Controls, 982
 Feeders, Demand Factors, 982
 Other Occupancies, 984

Services and Service Equipment, 187–254

Control and Protective Equipment, 211
 Current Supply, 198
 Enclosures, Wiring Space, 227
 Instrument Transformers, Enclosures, 251
 Metering Equipment, 241
 Oil Switches, Oil Circuit Breakers, 227
 Overhead Supply, 200
 Service Boxes, Fuse Enclosure, 218
 Service Boxes, Marking, 228
 Service Equipment, 211
 Sheathed Cable, 237
 Supply Services, Electric Railway, 199
 Supply Services, Permitted, 188
 Terminology, 187
 Three-Wire Consumer Service, 199
 Wiring Methods, 228

Service Stations. See **Gasoline Dispensing and Service Stations**

Solar Voltaic System. See **Photovoltaic Systems**

Spas. See **Pools, Tubs, Spas**

Spot Welders. See **Electric Welders, Resistance Type**

Supply Services, Number Permitted, 188

Swimming Pools. See **Pools, Tubs, and Spas**

Switches

Connection, 600
 Control Devices, 599
 Manually-Operated, 601, 602
 Manually-Operated, Circuits Exceeding 300 v, 603

Operation, 599
Rating, 600

T

Thermostats

Bathrooms, 987
Control Wiring, 994
Heated Floors, 987
Location, 987
Rating, 986
Type, 986

Transformers

Additional for Pools, Tubs, Spas, 1038
Capacitors, Supplying, 770
Conductor Size, 779
Continuous Load, 783
Dielectric Liquid-Filled, Indoor, 773
Disconnecting Means, 776
Dry-Core and Ventilated Type, 773
Electrical Equipment, 770
Electronic Devices, Pools, Tubs, Spas, 1038
Enclosures and, 1037
Grounding and Bonding, 782
Lighting Voltage, Pools, Tubs, Spas, 1038
Marking, 784
Minimum Distance, Pools, Tubs, Spas, 1038
Outdoor, 772
Roof-Mounted, 772

Tubs. See **Pools, Tubs, Spas**

V

Voltage Drop

Calculation, 1025
Conductor Sizing, 1024
Maximum Permitted, 1023
Photovoltaic Systems, 1023–1028
Tables, 1024

W

Wall Switches

Bathroom, 916
Distance from Tub, 916–936
Maximum Weight, 905–936
Small Bathrooms, 916–936

Welders, Electric. See **Electric Welders**

Wiring Methods, 397–554

Auxiliary Gutters, 488–489
Bare Busbars, 431
Bonding Continuity, 480, 487
Bonding of Boxes, 444
Boxes and Fittings, 443
Cable, Bending and Stapling, 436
Cable Protection, Cylindrical Bushing, 439
Cable, Running between Boxes and Fittings, 436–438
Ducts and Plenum Chambers, 397
Electrical Metallic Tubing, 482–487
Electrical Metallic Tubing, Supports, 484–485

Electrical Metallic Tubing, Use Restrictions, 483–484
Electrical Non-metallic Tubing, 487–488
Embedded, 438
Entry of Raceways and Cables into Buildings, 410
Exposed Exterior Wiring, 427
Fished Cable Installation, 443
Flame Tested Coverings, 413
General Requirements, 397
Hazardous Locations, Zone 1, 664–666
Hazardous Locations, Zone 2, 680
Hazardous Locations, Zone 20, 692–693
Hazardous Locations, Zone 21, 697
Hazardous Locations, Zone 22, 698–699
Installation, 432
Lightning Rod Connectors, 410
Manufactured, 525
Maximum Voltage, 431
Neutral Supported Cables, 430
Non-metal Sheathed Cable, 431
Open Wiring, 426
Outlet Boxes, 525–527
Outlet Boxes not Required, 443
Outlet Boxes, Wet Locations, 531
Outlet Box Supports, 528–530
Pools, Tubs, Spas, 1030
Protection, Concealed Installation, 439–442
Protection, Exposed Installation, 442
Protection, Joist and Rafters, 438
Raised Floors for Data Processing, 411
Terminal Fittings, 527
Underground Conduits, Entry into Building, 463
Underground Installations, 400
Wireways, 503–507
Work Rules, 445

Working Space

Access and Egress, 126