

One- and Two-Family Dwelling Electrical Systems – 2020 NEC

Provider: International Association of Electrical Inspectors – International Office (IAEI-IO)

Instructor: David Humphrey

Course Length/CEU: 8 Hours/0.8 CEU

Course Description:

This comprehensive course has been developed for those involved in design, installation, or inspection of electrical systems in new or existing dwellings. This presentation follows the outline of IAEI's *One-and-Two Family Dwelling Electrical Systems* publication, which is based on the 2020 NEC and the 2021 IRC.

Beginning with general requirements, this course will discuss the requirements for branch circuits and feeders, and the associated service load calculations, followed by the regulations for cabinets, panelboards, and meter socket enclosures established for one-and-two-family dwellings.

In Part two of this series, David Humphrey provides valuable information about the installation and inspection of services at one-and-two-family dwellings and grounding and bonding requirements for dwelling units.

Join David Humphrey as he provides an in-depth look at the requirements for personnel protection as well as power and lighting distribution in new or existing one-and-two-family dwellings.

Part Four of this series highlights the most significant changes in regulations concerning swimming pools and other aquatic installations, branch circuits and feeder runs to accessory buildings, and requirements for existing electrical installations.

Course Outline:

Part 1 2 Hours

- The relationship between NEC and IRC explained

Chapter 1 – General Requirements

- Purpose of the NEC
- Installation and Use
- Listed or Labeled Equipment
- Qualified Person
- Pride of Workmanship
- Mechanical Execution of Work
- Damp or Wet Locations
- Receptacle and Receptacle Outlet
- Enclosure Types
- Unused Openings
- Integrity of Electrical Equipment and Connections
- Mounting Equipment
- Conductor Material
- Wire Connectors and Conductor Terminations
- Equipment Marking
- Conductor Ampacity and Correction Factors

Chapter 2 – Branch Circuit, Feeder, and Service Calculations

- Planning for Future Expansion and Convenience
- Definitions
- Feeder and Service Load Calculations
 - Sizing of Service Entrance Conductors
 - Lighting Loads for Dwellings
 - Rules for Standard Load Calculations
 - Rules for Optional Load Calculations
 - Calculations for Two-Family Dwellings

Chapter 3 – Cabinets, Panelboards, and Meter Socket Enclosures

- Definitions
- Cabinets in Damp and Wet Locations
- Position in Walls and Repairs
- Cables Entering Cabinets and Cutout Boxes
- Wire Bending Space at Terminals
- Conductor Protection from Abrasion
- Wire Space in Enclosures
- Mounting and Location of Switches and Overcurrent Devices
- Circuit Directory and Identification
- Service Equipment Barriers
- Main Bonding Jumper
- Overcurrent Protection for Panelboards
- Grounding of Panelboards

Part 2 2 Hours

Chapter 4 – Installation and Inspection of Services

- General Requirements for Services
- Definitions
- Clearances on Buildings
- Clearances Above Roofs
- Clearances Above Final Grade
- Service Masts
- Service-Entrance Cable
- Service-Entrance Conductor Raceways
- Service Disconnecting Locations
- Marking of Service Disconnecting Means
- Emergency Disconnects
- Surge Protection
- Working Space Requirements
- Services for Outbuildings
- Sizing of Service-Entrance Conductors
- Overload Protection for Service-Entrance Conductors
- Panelboards

Chapter 5 – Grounding and Bonding for Dwelling Units

- Purpose of Grounding and Bonding
- General Requirements
- Definitions
- Grounded (Neutral) Conductor to Service Equipment
- Main Bonding Jumper to Service
- Bonding at Services
- Sizing Supply-Side Bonding Jumpers on Supply Side of Service Equipment
- Purpose of Intersystem Grounding and Bonding for Communication Systems
- Grounding Electrode System
- Grounding Electrodes
- Common Grounding Electrode
- Sizing Grounding Electrode System Bonding Jumpers
- Grounding Electrode Conductor Connections
- Grounding Electrode Conductor Installation
- Bonding Metal Enclosures
- Bonding of Piping Systems
- Bonding and Grounding of Remote Metering Equipment
- Supply Side Grounding and Bonding
- Grounding at Separate Buildings or Structures

Part 3 **2 Hours**

Chapter 10 – Personnel Protection

- Ground-Fault Circuit Interrupter (GFCI)
 - GFCI Principles of Operation
 - GFCI Protection Required in Dwellings – 210.8(A)
 - Bathrooms – 210.8(A)(1)
 - Garages and Accessory Buildings – 210.8(A)(2)
 - Outdoor Receptacles – 210.8(A)(3)
 - Crawl Spaces – 210.8(A)(4) and 210.8(C)
 - Basements – 210.8(A)(5)
 - Kitchen Countertop Receptacles – 210.8(A)(6)
 - Dwelling Unit Sinks - 210.8(A)(7)
 - Bathtub and Shower Stalls – 210.8(A)(9)
 - Laundry Areas – 210.8(10)
 - Indoor Damp and Wet Locations – 210.8(A)(11)
 - GFCI Protection for Boat Hoists/Boathouses – 555.9
 - Dishwashers – 422.5(A)(7)
 - Outdoor Outlets – 210.8(F)
 - Heated Floor Cables in Poured Concrete – 424.44(E)
 - Hydromassage Bathtubs – 680.71
- Arc-Fault Circuit-Interrupters (AFCI)
 - AFCI Protection Required – 210.12(A)
 - Combination AFCI Protection – 210.12(A)(1)
 - Dual Function AFCI/GFCI Protection – 210.12(A)/210.8(A)
 - Fire Alarm Systems – 210.12(A) Exception

- AFCI for Extensions or Modifications – 210.12(D)
- Tamper-Resistant Receptacles
- Smoke Alarms

Chapter 11 – Power and Light Distribution

- Minimum Sizes and Types of Conductors
- Total Load
- Definitions
- Branch Circuits Required
- Multiwire Branch Circuits – 210.4
- Grounding of Receptacles – 250.146 and 250.148
- Grounding of Switches – 404.9(B)
- Receptacle Rating – 210.21(B)
- Receptacle Locations and Spacing – 210.52(A)
 - Wall Space Requirements – 210.52(A)(2)(1)
 - Floor Receptacles – 210.52(A)(3)
 - Small Appliance Receptacles – 210.52(B)
 - Kitchen Countertop Receptacles – 210.52(C)
 - Bathroom Branch Circuits and Receptacles – 210.11(C)(3) and 210.52(D)
 - Outdoor Receptacle Outlets – 210.52(E)(1)
 - Balconies, Decks, and Porches – 210.52(E)(3)
 - Laundry Circuits and Receptacle Outlets – 210.11(C)(2) and 210.52(F)
 - Basements, Garages, and Accessory Buildings – 210.52(G)
 - Hallways – 210.52(H)
 - Foyers – 210.52(I)
- Lighting Outlets Required – 210.70(A)(1)
 - Control Devices at Stairways and Landings – 210.70(A)(2)(3)
 - Lighting in Storage or Equipment Spaces – 210.70(C)
- Review of Wiring Methods
 - Ampacity of Type NM Cables
 - Cable Protection Requirements
 - Ampacity Adjustment Factors
 - Securing and Supporting Type NM Cable

Part 4 2 Hours

Chapter 14 – Swimming Pools and Other Similar Aquatic Installations

- Parts of Article 680 relevant to Dwelling Units
- Ground-Fault Circuit Interrupters
- Grounding and Bonding Terminal - 680.7
- Cord-and-Plug Connected Equipment - 680.8
- Overhead Conductor Clearances - 680.9
- Underground wiring Locations - 680.11
- Receptacle Locations for Permanently Installed Pools - 680.22(A)
- Equipotential Bonding (680.26)
 - Not Permitted for Use as Grounding Electrodes - 250.52(B)(3)
- Bonding of Pool Water - 680.26(C)
- Definitions - 680.2

- GFCI Protection for Hydromassage Bathtubs - 680.71
- Accessibility for Hydromassage Bathtubs - 680.73
- Bonding at Hydromassage Bathtubs - 680.74(A)

Chapter 15 – Branch Circuits and Feeder Runs to Accessory Buildings

- Outside Feeders and Branch Circuits - Article 225
- Clearance for Overhead Conductors - 225.18
- Number of Supplies - 225.30
- Outbuilding Disconnecting Means
 - Disconnecting Means Locations - 225.32
 - Types of Disconnecting Means
- Grounding Electrodes - 250.32(A)
 - Methods for Grounding - 250.32(B)(1)

Chapter 16 – Existing Electrical Installations and Wiring

- Modifying Circuit/Equipment in Existing Dwellings
- Minimum Box Size - 314.16
- AFCI Protection for Branch Circuit Extensions or Modifications - 210.12(D)
- Support of “Old-Work” Style Boxes
- Knob-and-Tube Wiring - Article 394
- Junction Box Requirements - 314.17(C)
- Luminaire Tap Conductors - 410.117(C)
- Receptacle Replacements - 406.4(D)
- External EGC Added - 250.130(C)
- Replacement Where GFCI Protection is Required
- Replacement Where AFCI Protection is Required

Methods of Presentation: Pre-recorded GoToWebinar/Microsoft PowerPoint® Presentations

Optional Materials:

One- and Two-Family Dwelling Electrical Systems. 11th Edition, International Association of Electrical Inspectors (IAEI). 2020.

National Electric Code 2020. NFPA 70. 2019.

2021 International Residential Code for One-and Two-Family Dwellings. International Code Council, Inc. 2021.