

NEC 2023 Code Update

Interstates Construction Services Inc. has and will provide quality education to those that attend a program delivered by Interstates Construction Services. Interstate is a Sixty-Eight (68) year old company that provides industrial project construction, engineering, controls, and education to the electrical profession.

The instructor, Lowell Reith, has taught in the electrical field from 1988 to 2001 at North Central Kansas Technical College Beloit Kansas, and was an Instructor in Kansas in the Electrical Trades. Lowell is also a member of National Electric Code making panel #14. The National Center for Construction and Research also has certified Lowell as a Master trainer. Interstates and Lowell Reith are certified to provide continuing education to the following states: North Dakota, Wyoming, Idaho, Wisconsin, Minnesota, Montana, South Dakota, Michigan, Washington, Oregon, and Kentucky.

Instructor Travis Andersen has taught electrical apprenticeship classes for 6 years and before that ran his own business doing residential and commercial installations. Has been teaching CEU's for 4 year. Travis Andersen has been working in the electrical field since 1997 and ran his own business since 2007. Is now working with Interstates Inc. as a Craft Instructor in 2016. Is licensed in South Dakota and Iowa as a Contractor.

Instructor Keith Bunger has taught in the electrical field since 2011 first at North Central Kansas Technical College and now with Interstates Inc. doing apprenticeship class for 5 years. He has been teaching CEU's for 2 years. Has Journeyman licenses in Kansas and Nebraska. Keith is a certified trainer with NCCER.

Instructor Allan Hill taught in the electrical field from 1998 to 2019 at North Central Kansas Technical College and now with Interstates Inc. from 2019 to present. He is doing apprenticeship classes for Interstates and has done continuing ed classes before coming to Interstates. Allan is a certified trainer with NCCER.

Class Locations:

As stated on Application.

Class Schedule Dates:

Class will be schedule.

Class Numbers:

The minimum class sizes will be 8 people. Of those 8, not all have to be present for continuing ed for one state only. The cut-off date for the class minimum number will be fourteen (14) days before the class date.

Class Fees and Refunds:

Class fees will be \$150 for those attending the class.

Weather and Instructors:

If the weather should force the cancellation of a class, the next earliest date that will work for the provider will be used to reschedule the class. If the new date will not work with those pre-registered a full refund will be given to those requesting the refund. If the instructor does not show for the class a full refund will be given to all of those registered for the class.

Attendance Verifications For Classroom Courses:

Attendees will be required to present their State Electrical license and write the license number on the attendance sheet. Attendees will be required to sign out at the end of class to get credit for attending. See attached attendance sheet.

Course Materials:

Course materials will be the IAEI Analysis of Change 2023. The power point for the book will also be used.

NATIONAL ELECTRIC CODE UPDATE 2023
CONTINUING EDUCATION CLASS
COURSE OUTLINE.

8 Hours

Instructor: Lowell Reith

1.5 hour 7:30 – 9:00

1) Future of the NEC

- a) Possible changes in 2026
 - i) Redoing Chapters 7 and 8
- b) Possible changes in 2029
 - i) Redoing the whole book.
 - (1) Renumbering and chapter

2) Code Changes Schedule.

- a) Public Inputs
 - i) Usually start in Early 2023
 - ii) Ends around September 2023
- b) First Revision Meetings
 - i) January 2024
 - (1) Official Vote in March 2024
- c) Public Comments
 - i) Open around May 2024
 - ii) Closes around August 2024
- d) Second Revision meeting
 - i) Usually around end of October 2024
 - (1) Official vote around December.
- e) NFPA meeting June 2025

3) Code Wide Changes

- a) 2023 info
- b) Style Manual
 - i) Many changes in how the Codebook was written.
 - ii) Exceptions were rewritten
 - iii) Informational Notes rewritten.
- c) Article 100 Definitions all moved to article 100
- d) Making over 1000 Volts AC, 1500 V DC articles
 - i) Most over 1000 volt article end with the number 5, but not all.
- e) All year publications have been removed. This means last publication shall be used.

4) New Code Articles and Table

- a) Article 235 Branch Circuits, Feeders, and Services over 1000 Volts AC, 1500 V DC
- b) Article 245 Overcurrent Protection over 1000 Volts AC, 1500 V DC
- c) Article 305 General Requirements for Wiring Methods and Materials for systems over 1000 Volts AC, 1500 V DC
- d) Article 315 Medium Voltage Conductors and Cables. Moved from 311 new in 2020
- e) Article 335 Instrumentation Tray Cable, moved from 727
- f) Article 369 Insulated Bus Pipe (IBP) /Tubular Covered Conductors (TCC) systems
- g) Article 371 Flexible Bus Systems
- h) Article 495 Equipment over 1000 Volts AC, 1500 V DC, was 490 in 2020
- i) Article 512 Cannabis Oil Equipment and Cannabis Oil Systems using Flammable Materials
- j) Article 722 Cables for Power Limited Circuits and Fault Management Power Circuits
- k) Article 724 Class 1 Circuits – Was part of 725 in 2020
- l) Article 725 Class 2 and 3 Power Limited Circuits – Was the remainder of 725 in 2020
- m) Article 726 Class 4 Fault Management Power Systems.
- n) Table 13 Chapter 9, Equipment suitable for Hazardous (Classified) Locations.

5) Deleted Code Articles

- a) Article 311 Medium Voltage Conductors and Cables Article 285 Surge Protection Devices. Now Article 315
- b) Article 490 Equipment over 1000 Volts Nominal. Now article 495
- c) Article 510 Hazardous (Classified) Location
- d) Article 712 Direct Current Microgrids
- e) Article 727 Instrumentation Tray Cable now Article 335

6) Chapter 1 General

1.25 hour 9:00 – 10:15

a) Article 90 Introduction

- i) 90.5 (C) Explanatory Materials – The dates have been removed unless noted the lasted publication shall be used.

b) Article 100 – Definitions – All definitions are now in article 100. Approximately 800 total.

- (1) Most articles that had a .2 had the definitions moved to article 100.
- (2) Found there were multiple definitions in different articles for the same name.
- (3) If the Definition has a Code Article number at the end it is used only in that article Ex (516)
- (4) Many new definitions
 - (a) Counter (Countertop)
 - (b) Energy Management Systems
 - (c) Fibers/Flyings Combustibles
 - (d) Impedance Grounded System. (HRG)
 - (e) Likely to become Energized
 - (f) Normal High-Water Level
 - (g) PV DC Circuit, PV Source Circuits, PV string Circuits
 - (h) Restricted Industrial Establishment
 - (i) Servicing
 - (j) Short Circuit
 - (k) Work Surface
 - (l) And many more. Be sure to review the article.

c) Article 110 Requirements for Electrical Installations

i) 110.3(A) Installation and Use of Labeled Equipment

- (1) #8 Cybersecurity for network-connected life safety equipment

ii) 110.3(B) Installation can now be done by QR codes.

iii) 110.14 (A) Electrical Connections

- (1) Mechanical connections changed to Electrical Connections

iv) 110.16 (B) Arc Flash Warnings

- (1) The word feeder was added for a permanent Arc Flash Label requirements
- (2) The Arc Flash Label shall be in accordance with Applicable Industry Practices
 - (a) NFPA 70 E

- (3) Reduced the amperage level from 1200 amps to 1000 amps

v) 110.17 Servicing and Maintenance of Equipment

- (1) Put requirements in on who services and maintains electrical equipment.
 - (a) Shall be a qualified person trained to do the work.

vi) 110.20 Reconditioned Equipment

- (a) Has 2 Sections
 - (i) Equipment required to be listed
 1. Shall be field evaluated as reconditioned, or listed as such
 - (ii) Equipment not required to be listed.
 1. Shall be field evaluated as reconditioned, or listed as such
 2. Be reconditioned as manufactured recommended.

vii) 110.21(A)(1) Equipment Markings

- (1) Requires the label to be applied or affixed to the equipment in a permanent manner.

viii) 110.21(A)(2) Reconditioned Equipment

- (1) What needs to be on the label stating it is reconditioned equipment.

ix) 110.21(B)(1) Markings-Field-Applied Hazard Marking

- (1) Requirements on what is needed for the labels.

x) 110.22(A) Identification of Disconnecting Means

- (1) Drops the label requirement if it is evident what it goes to.

xi) 110.26 Space about Electrical Equipment.

- (1) The access and egress from equipment was moved from large equipment to the general clearing language.
 - (a) This means it applies to all electrical equipment.
 - (b) 24" x 6.5' openings.

xii) 110.26(A)(6) Grade, Floor, or Working Platform.

- (1) Working space needs to be clear and level and flat as practical.

xiii) 110.29 In Sight From

- (1) Was revised and moved from Article 100 to 110.29
 - (a) Definitions cannot have requirements in it.
- xiv) **110.33(A) Entrance to Enclosures and Access to Working Space. Over 1000 V AC or 1500 V DC**
 - (1) Having the space to get out of the working space.
- xv) **110.34(A) Working Space and Guarding Over 1000 V AC or 1500 V DC**
 - (1) Grade, Floor, or Working Platform.
 - (a) Working space needs to be clear and level and flat as practical.

Break 10:15 – 10:30 AM

7) Chapter 2 Wiring and Protection

1.5 hours 10:30 – 12:00

a) Article 210 Branch Circuits

- i) **210.2 – Recondition equipment as it applies to Article 210.**
- ii) **210.8(A)(6) Dwelling Unit-Kitchens**
 - (1) All Kitchen receptacles are now required to be GFCI protected.
 - (2) For 125 volts to 250 volts, no amperage limits
- iii) **210.8(A) Exception #4 Exhaust Fan Receptacle inside the fan**
- iv) **210.8(A) Exception #3 and 210.8(B) Exception #6**
- v) **210.8(B)(4) GFCI on Buffet serving equipment**
 - (1) Equipment that has power to heat water to keep the food hot.
- vi) **210.8(B)(7) The 6-foot rule**
 - (1) Is now from the equipment not the receptacle.
- vii) **210.8 (B)(13) Aquariums and Bait Wells**
- viii) **210.8(D) Specific Appliance**
 - (1) A list was made of what needed to be Protected
 - (2) Any circuit 150 volts to ground or less and 60 amps or less. single or 3 phase
- ix) **210.8(F) Outdoor Outlets**
 - (1) Applies to all outlets.
 - (2) An Ex for HVAC has been pushed to Sept 1, 2026.
- x) **210.11(C)(4) Garage Branch Circuits**
 - (1) Revised to make sure it is ok to use a 15-amp circuit after the required 20 amp if desired.
 - (2) An Ex was added to allow the required 20-amp circuit to do other things on a single car garage.
- xi) **210.12 Arc Fault Circuit Interrupter Protection**
 - (1) Reformatted and added the 10-amp circuit breaker.
- xii) **210.12(D)(3) Other sleeping locations**
 - (1) Such as Firehouses, EMT center, etc.
- xiii) **210.17 Guest Rooms and Guest Suites**
 - (1) Using dwelling unit requirements if Guest rooms and suites have cooking provisions.
- xiv) **210.19 Conductor Ampacity and Size**
 - (1) The voltage limit applies to the circuit not just the insulation of the conductors. Just clearing it up.
- xv) **210.23 10-Amp Circuits and what it is used for.**
 - (1) Used for dwelling lighting, Exhaust fans for bathrooms and laundry areas.
- xvi) **210.52(C) Islands and Peninsula Counter tops and work surface**
 - (1) Receptacle outs not required anymore
 - (2) Must have a way to get the receptacle powered if wanted later.
- xvii) **210.52(G) Basements, Garages and Accessory Buildings**
 - (1) Receptacles powering security systems do not need to be GFCI protected.
- xviii) **210.70 Lighting Outlets Required**
 - (1) Added Laundry for required lighting needed.

**.5-hour Lunch Break
12:00 – 12:30**

b) Article 215 (Feeders)

1.5 Hrs 12:30 -2:00

- i) **215.15 Barriers**
 - (1) Feeder taps or Transformer secondaries need Barriers on them like services
- ii) **215.18 Surge Protection on Feeders**

- (1) Dwellings, Dorms, Guest rooms Hotels, Motels, Nursing home sleeping area circuits.
- (2) Companion articles 225.42 and 230.67

c) Article 220 Branch Circuits, Feeders, Service Load Calculations Under 1000 V AC

i) 220.5(C) Floor Area

- (1) Garages now count as living space for load calculations
 - (a) $Sq \times 3 \text{ va}$
- (2) **220.57 Electric Vehicle Supply Equipment**
 - (a) 7,200 VA or nameplate whichever larger
 - (i) Based on a 30a, 240-volt single phase circuit.
 - (b) Not part of the fixed Appliance loads of 220.53
- (3) **220.70 Energy Management Systems**
 - (a) Allows for managing loads in a building.
 - (i) Example would be the Electric Vehicle chargers.
 - 1. Limits the charging rate based on overall load on the service.
- (4) **220.110 Hospital Receptacle load**
 - (a) Demand of hospital receptacle load was moved from 517 as it deals with a load calculation.
- (5) **220.120 Marinas, Boatyards, Floating buildings, Commercial and Non-Commercial Docks**
 - (a) Shore Power Receptacle demand table. Moved from article 555. As it is a load calculation.

ii) Article 225 Outside Branch Circuits and Feeders

- (1) **225.5 deleted as the article is now just for under 1000 V AC or 1500 V DC**
- (2) **225.7 deleted as it was covered in Article 210**
- (3) **225.41 Emergency Disconnects**
 - (a) Required for 1 and 2 family dwellings
 - (i) On or in sight of the dwelling
 - (ii) SSCR must be equal or greater than the Available fault current
 - (iii) If more than one disconnects must be grouped
 - (iv) Identification of disconnects.

iii) Article 230 Services

- (1) **230.62(C) Barriers**
 - (a) Revised to make clear the line side of the main is covered
 - (i) Means the main shall be open before doing load terminations
- (2) **230.67(A) Surge Protective devices**
 - (a) Added places for surge protection
 - (b) Rating of SPD has to be at least 10 KA SSCR
- (3) **230.71(B) Barriers between Sections of Switchgear**
 - (a) To count as only one disconnect a barrier must be between sections
 - (b) MCC's that are service rated
- (4) **230.71(B) Ex**
 - (a) Allows doe existing equipment to have OCPD added up to 6 in one enclosure.
- (5) **230.85 Emergency Disconnects**
 - (a) Revised into a list type format
 - (b) What type of disconnect can be used.
 - (c) Replacement requires the disconnect
 - (d) Labels or plaque to tell where disconnect is for other energy sources

iv) Article 235 Branch Circuits, Feeders, and Services over 1000 V AC or 1500 V DC

- (1) New article
 - (a) Parts taken from articles 220, 225, and 230.

v) Article 240 Overcurrent Protection

- (1) **240.2 Reconditioned Equipment**
 - (a) Moved from other location in article 240.
- (b) **240.4(B) Over 800 Amp**
 - (i) Allowing the adjustable breaker to be set up to the next standard setting.
- (c) **240.4 (D) Small conductor Rules**
 - (i) Added #14 Copper Clad Aluminum.
 - 1. Limited to 10 amps

2. OCPD must be listed to be used with #14 Copper Clad AL.
 3. Was not added to table 310.16
 - a. Shows the issues with the different code panels and correlating committee.
 - (d) **240.4 (H) Dwelling unit OCPD to match 310.12**
 - (e) **240.6 OCPD Standard sizes**
 - (i) Added 10 A Breaker
 - (ii) Removed it out of the fuse list of extra sizes.
 - (f) **240.6(D) Remotely Accessible Adjustable Trip Circuit Breakers**
 - (i) Allows breakers to be networked connected
 1. Inspectors could ask for proof of cyber-security of the equipment.
 - (g) **240.7 Listing Requirements**
 - (i) Branch Circuit OCPD must be listed
 - (ii) Relays and Circuit Breakers providing GFPE shall be listed
 - (iii) GFCI must be listed
 - (h) **240.11 Selective Coordination**
 - (i) IF any feeder is required to have Selective Coordination All feeders shall have it.
 - (i) **240.16 Interrupting Ratings**
 - (i) All OCPD shall have a minimum of 5,000 amp Interrupting rating
 - (j) **240.24(A) Accessibility – Exception**
 - (i) Allows Hazardous Location Panels
 - (ii) Required that the OCPD inside the enclosure meet all the rules of Accessibility
 1. 6’7” requirement
 - (k) **240.24(E) OCPD in Bathrooms**
 - (i) OCPD are now not allowed in any location Bathroom, showering facility or lockers with showers
 - (ii) Can have supplementary OCPD in the rooms.
- vi) **Article 242 Recondition Equipment**
- (1) **242.2 Reconditioned Equipment**
 - (a) SPD and Surge Arrestors cannot be reconditioned.
 - (2) **242.9 SPD Indicating**
 - (a) Shows that the device is working correctly
- vii) **Article 245 OCPD rated over 1000 V AC or 1500 V DC.**
- (1) New Code article for OCPD rated over 1000 V AC
- viii) **Article 250 Grounding and Bonding**
- (1) **250.24 D 2 Conductors installed in parallel was C 2**
 - (a) Reworded for clarity and moved.
- ix) **Article 250.30 (C)**
- (1) Took the word neutral out and put in **Impedance grounded system.**
- x) **Article 250.36 Impedance Grounded Systems**
- (1) Took out the word High and Neutral from the heading.
- xi) **Article 250.50 (A)(3)**
- (1) Changed reinforcing steel or rods to REBAR
- xii) **Article 250.64 (G) Grounding Electrode Conductor and Vent openings**
- (1) Made it clear that you cannot install the GEC through vent openings as it reduces the vent opening space
- xiii) **Article 250.70 Method of Grounding and Bonding conductor Connections to electrodes**
- (1) Made it into 2 parts.
 - (2) If in the ground or concrete shall be list for that.
- xiv) **Article 250.94 (A)**
- (1) Just reworded for clarity.
- xv) **Article 250.106**
- (1) Redid the informational notes. Nothing really changed.
- xvi) **Article 250.118 (A)(6)(f) Stainless steel flex in liquidtight for corrosion.**
- (1) Stainless steel has higher resistance than regular metal in the flex
 - (a) This will require a EGC either inside or outside the flex.
- xvii) **Article 250.130 Equipment Grounding Conductors Connections**
- (1) Snap switches
 - (a) Added snap switches to be connected to and EGC.
 - (2) Article 250.140 (B)(5) Insulated Range Conductor

- (a) Uninsulated conductor can be taped to cover it
- (3) Article 250.148 Continuity of the EGC and attachment to Boxes
 - (a) Clarify the requirement that only the spliced or terminated EGC must be connected together.
 - (b) Revised how to size bonding jumpers
 - (i) Based on 250.122

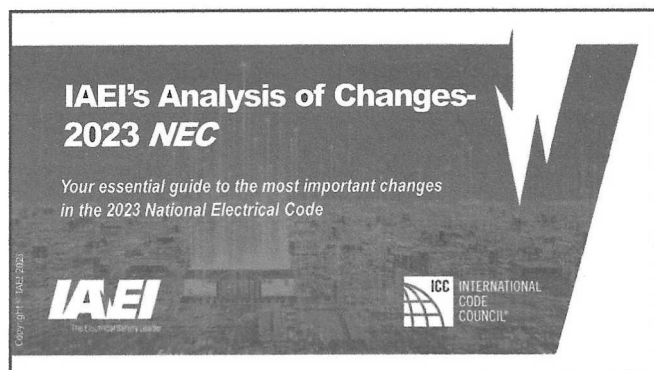
Break 2:00 -2:15
2.25 Hour 2:15 – 4:30

8) Chapter 3 Wiring Methods and Materials

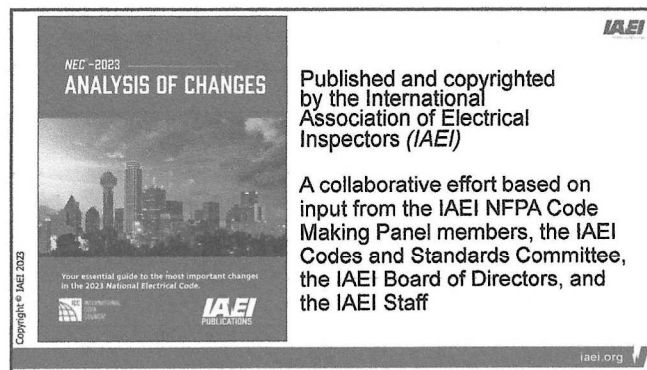
a) Article 300 (Wiring Methods)

- i) 300.2 Voltage Limited to 1000 V AC or 1500 V DC
 - ii) 300.4 (E) Ex 1 and 2
 - (1) Ex 1- Steel boxes and mailable boxes do not need the 1 ½” space
 - (2) Ex 2- 2” of concrete on rooftop deletes the 1 ½” spacing requirement.
 - iii) 300.4 (G) Fittings on Conduits
 - (1) Bushing need to be installed before conductors are installed.
 - (a) Want to protect the wire as it is being installed.
 - iv) Table 300.5 Note 6 EMT in the ground
 - (1) In Column 3 of Table
 - (2) Need to have corrosion protection added.
 - v) Article 300.5(D) Conductors need to be Protected
 - (1) Added Conduit in the ground need to be protected as well as conductors.
 - (2) Deleted direct buried conductors
 - vi) Article 300.6(A) Ferrous Metal Protection
 - (1) Added the word anywhere threaded needs protection
 - (a) This means the prefab shop, in the field, anywhere.
 - vii) Article 300.11(C) Raceway used as Supports
 - (1) Can support Class 2 and Class 3 type circuits, added the Class 3.
 - (a) Must be for the control of the equipment powered by the raceway.
 - (2) Article 300.14 Free Conductor Rule – 6”
 - (a) Can be Spliced or not spliced. Just have the 6”
 - viii) Article 300.17 Cables and Conductors in Raceways
 - (1) Added Cables as well as Conductors for installation
 - ix) Article 300.25 EX. Outside Egress Lighting
 - (1) If needed Outside egress lighting can be supplied from the inside of the Stair Tower.
 - x) Article 300.26 Remote Control and Signaling Circuit Classification
 - (1) Setting up 3 types of remote-control circuits.
 - (a) Class 1 Power Limited
 - (b) Class 2 and Class 3 Power Limited
 - (c) Non-Power Limited – Normal Wiring
- b) Article 305 General Requirements for Wiring Methods and Materials for over 1000 V AC and 1500 V DC**
- (1) New Article
 - (a) Took the over 1000 V AC from Article 300 and moved to 305
- c) Article 310 (Conductors for General Wiring)**
- i) XHWN is rated at 75 C in 310.4 Table, is listed for 90 in table 310.16
 - (1) Should be deleted in 310.16
- d) Article 312 (Cabinets, Cutout Boxes, and Meter Sockets)**
- i) Article 312.10 Screws and Other Fasteners
 - (1) What type of screws and how far they can be inside the enclosure.
- e) Article 314 (Outlet Boxes, Pull and Junction Boxes)**
- i) Article 314.5 Screws and Other Fasteners.
 - (1) Gives info on what type of screws and other fasteners can be used inside the box.
 - ii) Article 314.16 (B)(6)
 - (1) Terminal Block Fill
 - (2) If installing Terminal blocks how much fill in a box they take up.
 - (a) Count as 1 wire, largest connected to the terminal block.
 - iii) Article 314.24 (C) Dimensions of Boxes

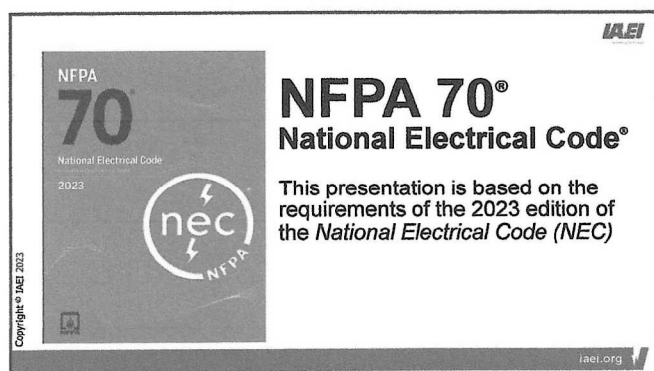
- (1) Must have side room to allow wire into the box if a device is installed.
- f) Article 315 Medium Voltage Conductors, Cables, Cable Joints, and Cable Terminations.**
 - i) Not new but moved from Article 311
- g) Article 320 Armored Cable**
 - i) Article 320.23 (A) Framing Members
 - (1) Word change from Joist to Framing Members
- h) Article 330. Metal Clad Cable**
 - i) 330.112(A) 1000 V cable using #16 AWG for Control and Signaling.
- i) Article 342 Intermediate Conduit (IMC)**
 - i) Article 342.20 (B) Max Size
 - (1) Increased to a Max size of 6"
- j) Article 344 Rigid Metal Conduit (RMC)**
 - i) Article 344.28 Reaming and Threading RMC
 - (1) Added PVC coated RMC to follow manufactures instruction to ream and thread.
- k) Article 352 PVC Conduit**
 - i) Article 352.10 (B) New
 - (1) Allows PVC to be installed directly into the concrete. Something that has been done for years.
 - ii) Article 352.10(K) Using only Schedule 80 Fittings and Elbows with Schedule 80 Conduit
 - iii) Article 352.44 Expansion Fittings
 - (1) Needed if ¼" of movement or more
 - (a) Around a 10-foot stick needs a fitting
 - (2) Needed for ground movement.
- l) Article 353 HDPE Conduit**
 - i) Article 353.48 Joints
 - (1) Follow manufacture requirements.
 - (a) Care must be taken on fusion or fiction methods which could cause issues inside
- m) Article 358. Electrical Metallic Tubing (EMT)**
 - i) Article 358.20 (B) Max Size – 6"
- n) Article 369 Insulated Bus Pipe/Tubular Covered Conductors New Article**
 - i) Used Most for Medium Voltage.
 - (1) Up to 35,000 volts
 - (2) Was in a lot of utilities and ships, as well as in Europe.
- o) Article 371 Flexible Bus Systems – New Article**
 - i) Has been used in places already.
 - ii) Has to be listed.



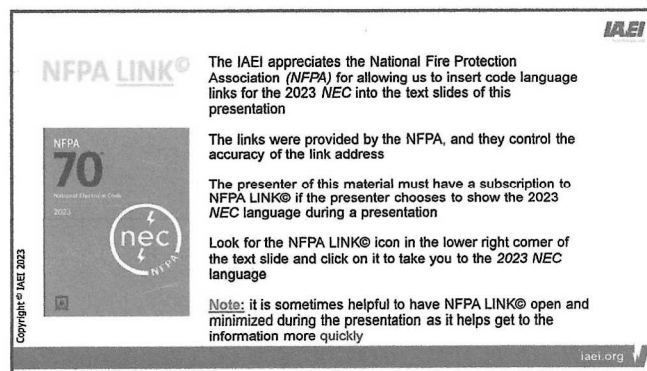
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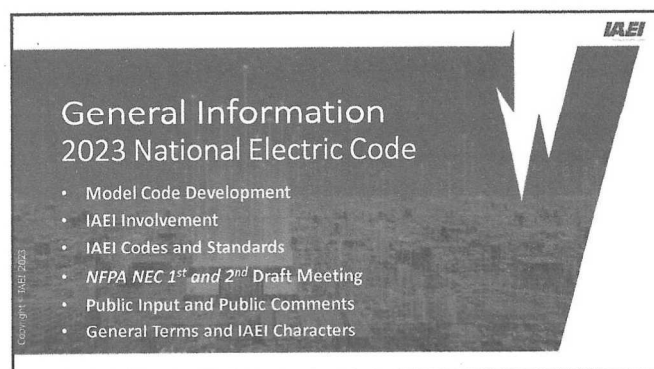
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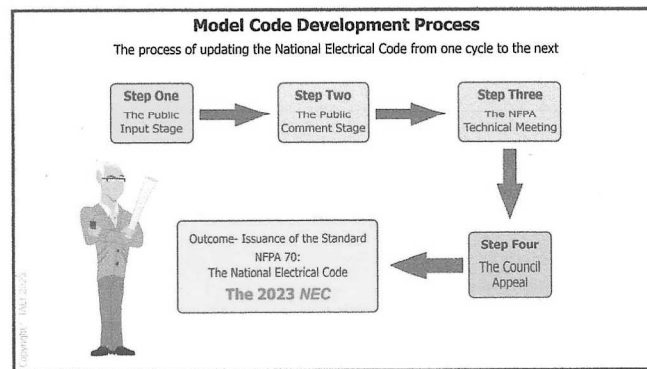
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5



6

The Development of the 2023 NEC

Interesting information about this revised document

- ▲ IAEI provided 36 members as CMP representatives to the NEC revision process
- ▲ IAEI Codes and Standards Committee vetted and submitted IAEI endorsed Public Inputs and Public Comments to NFPA for consideration
- ▲ NFPA NEC First and Second Draft meetings were conducted virtually instead of in person
- ▲ Code Making Panel Task Group meetings were also conducted virtually
- ▲ There following were submitted to NFPA for this edition of the Code:
 - ✎ 4006 Public Inputs
 - ✎ 900 Second Revisions
 - ✎ 1805 First Revisions
 - ✎ 441 Correlating Notes
 - ✎ 1956 Public Comments
 - ✎ 55 Certified Amending Motions
- ▲ Several IAEI members served on NFPA Correlating Committee Task Groups to work on issues needing to be resolved

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Code-Wide Changes

- NEC Style Manual Changes
- Definition Location
- Reconditioned Equipment
- Medium Voltage Requirements
- Copper Clad Aluminum
- New Articles for 2023 NEC

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8

The NEC Style Manual

Revised in 2020 and used for the 2023 NEC and 2024 version of NFPA 70E

- ▲ Purpose of the Style Manual is to make the code usable and clear and to provide formatting provisions
- ▲ Deletion of redundant language (*prohibits repeating language from Chapters 1-4 in other chapters of the NEC*)
- ▲ Significant Changes for the 2020 edition include actions involving:
 - ✎ Parts
 - ✎ Multiple Definitions
 - ✎ Definitions
 - ✎ Similar and Alternate Terms
 - ✎ Searchability
 - ✎ Informational Notes
 - ✎ Article Numbers
 - ✎ Acronyms
 - ✎ CMP References

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David Williams, NEC Correlating Committee

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9

Definitions

Definitions were relocated to Article 100 and arranged in alphabetical order with no parts

- ▲ Article 100 now contains approximately 840 definitions
- ▲ Additional definition structure requirements were also added to this Code cycle
- ▲ This allows the NEC to follow the same layout as other NFPA documents that have all definitions in one chapter
- ▲ Similar terms and acronyms may be used along with provisions for electronic searching
- ▲ Relocation revealed multiple terms defined differently in the code, which were also addressed with the NEC Style Manual revision
- ▲ An article number appearing after the defined term indicates the definition only applies to that article

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David Williams, NEC Correlating Committee and CMP-1, Greg Chontow

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10

Reconditioned Equipment

The xxx.2 sections in many chapters have become "placeholders" for requirements for reconditioned equipment

- ▲ This placeholder location (xxx.2) was made possible by the movement of all definitions that used to reside in these sections to Article 100
- ▲ This will allow code-making panels the opportunity to place requirements for reconditioned equipment in sections of the NEC that they have purview over
- ▲ These changes will make the NEC a more user-friendly document

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IAEI CMP and IAEI CSC Input

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11

Medium Voltage Requirements

Several new articles appeared in the 2023 NEC regarding the inspection and installation requirements for medium voltage conductors and equipment

- ▲ Article 235 Branch Circuits, Feeders and Services Over 1000 Volts ac, 1500 Volts dc, Nominal
- ▲ Article 245 Overcurrent Protection for Systems Rated Over 1000 Volts AC, 1500 Volts DC
- ▲ Article 305 Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal
- ▲ Article 315 Medium Voltage Conductors, Cable, Cable Joints, and Cable Terminations
- ▲ Article 495 Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal

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Copper-Clad Aluminum (CCA)

The following three slides contain information about Copper-Clad aluminum conductors

- ▲ Copper-clad aluminum (CCA) underwent extensive review and testing overseen by the NFPA Bimetallics Task Group formed at the direction of the Standard's Council after the 2020 NEC cycle
- ▲ The Task Group represented all the industry stakeholders, and the testing data provided a direct comparison of the performance of 14 AWG CCA to 14 AWG copper at their respective 50 degree C ampacities, demonstrating the safety of CCA
- ▲ A new table was added to 210.24, identified as 210.24(2), which summarizes the branch circuit applications for aluminum and CCA as had been permitted for over 50 years, where only copper conductors had this summary information provided in previous code editions

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Copper-Clad Aluminum (CCA)(cont.)

- ▲ CCA bare bimetal conductor material will have a listing requirement
- ▲ In addition to the listings for finished insulated conductors and cable assemblies, conductors made with CCA must carry a listing for the bimetal itself
- ▲ The listing will ensure that the core of the CCA is 8000 series aluminum, and that a metallurgical bond exists between the aluminum core and the copper outer layer
- ▲ Listing will prove that it meets ASTM product design requirements
- ▲ The smallest standard size of overcurrent protection is 10 amperes due to more energy-efficient products such as LED lighting and in anticipation of 14 AWG CCA being added to the ampacity tables in Article 310

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Copper-Clad Aluminum (CCA)(cont.)

- ▲ Code-Making Panel 1 reconfirmed in Section 110.14, Electrical Connections, that CCA and copper are only dissimilar to single metal aluminum when intermixed but not to each other for the application of the requirement
- ▲ Code-Making Panel 16, with purview over Article 770, reconfirmed that Copper Clad Steel wire and cable is an appropriate material for use as a Grounding Electrode Conductor (GEC) and is considered an equivalent in terms of grounding to a copper GEC

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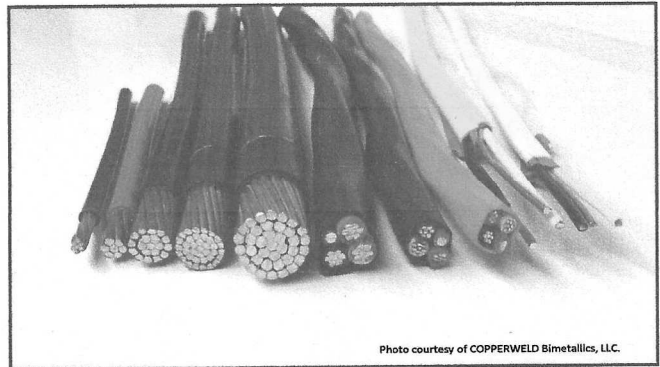


Photo courtesy of COPPERWELD Bimetallics, LLC.

16

New Articles for the 2023 NEC

Thirteen (13) new articles have been added to the 2023 NEC:

- ✎ Article 235
 - Branch Circuits, Feeders and Services Over 1000 Volts ac, 1500 Volts dc, Nominal
- ✎ Article 245
 - Overcurrent Protection for Systems Rated Over 1000 Volts ac, 1500 Volts dc
- ✎ Article 305
 - Wiring Methods and Materials for Systems Rated Over 1000 Volts ac, 1500 Volts dc, Nominal

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New Articles for the 2023 NEC (cont.)

Thirteen (13) new articles have been added to the 2023 NEC:

- ✎ Article 315
 - Medium Voltage Conductors, Cable, Cable Joints, and Cable Terminations
- ✎ Article 335
 - Instrumentation Tray Cable
- ✎ Article 369
 - Insulated Bus Pipe/Tubular Covered Conductors
- ✎ Article 371
 - Flexible Bus Systems

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New Articles for the 2023 NEC (cont.)

Thirteen (13) new articles have been added to the 2023 NEC:

- ✎ **Article 395**
 - Outdoor Overhead Conductors Over 1000 Volts
- ✎ **Article 495**
 - Equipment Over 1000 Volts AC, 1500 Volts DC, Nominal
- ✎ **Article 512**
 - Cannabis Oil Equipment

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New Articles for the 2023 NEC (cont.)

Thirteen (13) new articles have been added to the 2023 NEC:

- ✎ **Article 722**
 - Cables for Power-Limited Circuits, Fault-Managed Power (Class 4) Circuits
- ✎ **Article 724**
 - Class 1 Power-Limited Circuits and Class 1 Power-Limited Remote-Control and Signaling Circuits
- ✎ **Article 726**
 - Class 4 (CL4) Power Systems

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Deleted Articles for the 2023 NEC

Five (5) articles have been deleted for the 2023 NEC:

- ✎ **Article 311** (contents moved to new Article 315)
 - Medium Voltage Conductors and Cables
- ✎ **Article 490** (contents moved to new Article 495)
 - Equipment Over 1000 Volts, Nominal
- ✎ **Article 510**
 - Hazardous (Classified) Locations - Specific
- ✎ **Article 712**
 - Direct Current Microgrids
- ✎ **Article 727**
 - Instrumentation Tray Cable (contents moved to new Article 335)

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Chapter 1 General

- Article 90
- Article 100
- Article 110

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90.5(C) Explanatory Material

Revised to state that unless a standard referenced in the NEC contains a date, that reference is to be considered the latest edition of the standard

- ▲ CMP members spend a lot of time and effort making date changes to referenced standards that appear in the NEC
- ▲ In instances where a date is not included with the referenced standard, the user of the Code should understand this to mean the latest standard available
- ▲ Will reduce the number of public inputs and public comments submitted to modify a date for a standard referenced in the NEC

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90.5(C) Explanatory Material

SANDIA REPORT
SAND2004-3035
Estimated Release
Printed December 2004

Photovoltaic Array Performance Model

D.L. King, W.E. Boyson, J.A. Kratochvil

Prepared for
Sandia National Laboratories
Albuquerque, New Mexico 87185-1206
Sandia is a multiprogram laboratory operated by Sandia Corporation,
a Lockheed Martin Company, for the United States Department of Energy by
National Nuclear Security Administration under contract DE-AC02-04OR21400.

Approved for public release; further dissemination unlimited.
Sandia National Laboratories



Photovoltaic Wire

UL Standard
● Scope
● Summary of Topics
Standard 4703, Edition 1
Edition Date September 30, 2014
ANSI Approved July 21, 2020

In instances where a date is not included with the referenced standard, the user of the Code should understand this to mean the latest standard available

Example: 690.31 Wiring Methods, (C) Cables.
Informational Note: See UL 4703, Standard for PV Wire and UL 3003, Distributed Generation Cables, for DG Cable (no date posted, assume latest available)

24

Article 100 Definitions

The definitions that were in various locations of the NEC and in the XXX.2 placeholders have been relocated to Article 100

- ▲ Article 100 has changed its scope to reflect these changes
- ▲ Contains definitions essential to the application of the Code
- ▲ This change is in response to changes in the NEC Style Manual
- ▲ Helps to standardize the NEC with other NFPA standards
- ▲ The three parts of Article 100 have been eliminated
- ▲ The definitions will be found in alphabetical order
- ▲ Several new definitions were also added to Article 100
- ▲ Definitions followed by brackets have been extracted from another standard

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Article xxx.2 Sections to Article 100

All definitions will now be found in Article 100 of the National Electrical Code

This change is in response to changes with the NEC Style Manual

Helps to standardized the NEC with other NFPA standards



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Article 100 Definitions- Searchability

Bonding Jumper, Equipment Bonding Jumper, Main Bonding Jumper, Supply-Side Bonding Jumper, System Bonding Jumper, Solidly Grounded, Equipment Grounding Conductor

- ▲ Language for the above definitions has not changed
- ▲ Revised these definition titles to aid in electronic searches
- ▲ The acronyms were also removed
- ▲ Makes it so much easier for the electrical professional to search for terms while using electronic PDF files or other online platforms such as NFPA Link™

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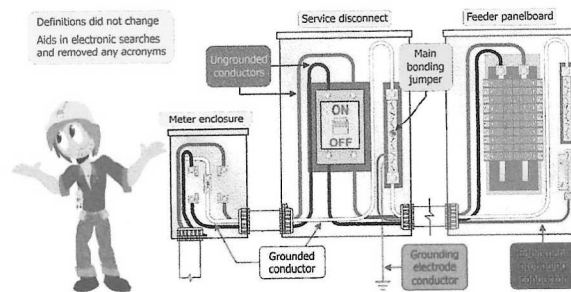
CMP- 5, Bill Pancake

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Article 100- Definitions (Multiple Definitions)

Definitions did not change
Aids in electronic searches
and removed any acronyms



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Article 100- Accessible (applied to wiring methods)

Substantiation was submitted to CMP-1 to make modifications to the definition of "Accessible" as it applies to wiring methods

- ▲ Revision clarifies that wiring and electrical equipment made inaccessible by piping, ductwork, drains, raceways, or other mechanical systems is not considered as accessible as applied to wiring methods
- ▲ Access to the wiring contained within this equipment is sometimes made very difficult
- ▲ This can require removal or disassembling of piping, raceways, or other equipment, which, where present, tended to defeat the purpose of using the term "accessible" in Code requirements that use the term
- ▲ Building-related items such as electrical raceways, plumbing pipes, and mechanical systems were considered accessible because they are not part of the structure or finish of the building, and the definition did not cover anything else

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Article 100- Accessible (applied to wiring methods)

Modifications were made to the definition of "Accessible" as it applies to wiring methods

Just-In-Time Jeff says:
Please think of me and my safety as you install this electrical equipment.
I need to maintain it!

Clarifies that wiring and electrical equipment cannot be made inaccessible by piping, ductwork, drains, raceways, or other mechanical systems



Photos courtesy of IAEI Archives

30

Article 100- Class 4 Circuit

A new definition for a Class 4 Circuit has been added as it applies to equipment and installations located in Article 726

- ▲ This was the result of the Packet Energy Transfer (PET) Systems Task Group tasked to provide guidance towards this new technology
- ▲ This emerging technology has been referred to in the past as Packet Energy Transfer (PET), Digital Electricity (DE), Pulsed Power, Smart Transfer Systems and Fault Managed Power (FMP)
- ▲ Involves a fault-managed system that verifies the powered device is present and operating correctly prior to a greater than Class 2 power being applied (a fault would cause a termination of the output power)
- ▲ Must ensure safety in the design, implementation, installation, and use of this technology
- ▲ There are now a total of seven (6) definitions associated with this Class 4 technology

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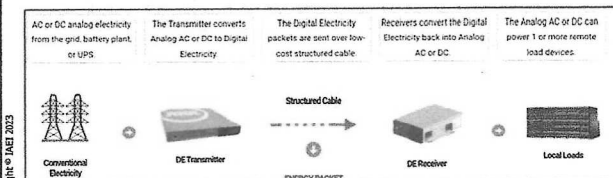
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Article 100- Class 4 Circuit (cont.)

Flowchart describing how this process works (courtesy of Voltserver)



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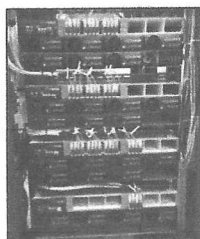
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Article 100- Class 4 Circuit (cont.)

Equipment associated with Class 4 Circuit distribution (courtesy of Voltserver)



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Article 100 Definitions- Counter (Countertop)

A new definition was added to help users of the Code understand what constitutes a "Counter (Countertop)" location

- ▲ There appears to be installer and enforcement confusion, as well as frequent product misapplications resulting from electrical equipment being installed incorrectly on these surfaces
- ▲ The key distinction between a work surface and a countertop is the quantity of spillage that the surfaces may be subjected (Generally, a counter application assumes a greater volume of spillage)
- ▲ The electrical professional will be directed to the industry standards that aid in the proper application of receptacles in these locations
- ▲ See Informational Note No. 1 for a reference to UL 498, Receptacles and Attachment Plugs, and UL 943, Ground-Fault Circuit-Interrupters
- ▲ See Informational Note No. 2 for information on receptacles for counters and countertops distinguished from receptacles for work surfaces

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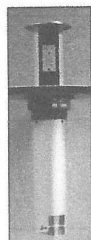
CMP- 2, Joseph Wages, Jr.

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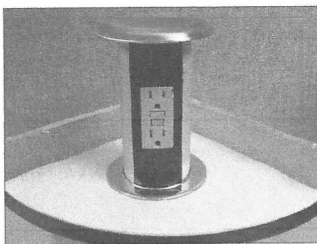
34

Article 100 Definitions- Counter (Countertop)

The key distinction between a work surface or a countertop is the quantity of spillage that the surfaces may be subjected (see Work Surface definition in upcoming slide)



- Features:
- listed for application
 - flange raised above surface to prevent liquid from entering
 - sealed when in the closed position to prevent liquid from entering
 - only energized in the upright position
 - GFCI protected



Courtesy of ABB, Thomas and Betts

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Article 100 Definitions- Energy Management System

A new definition for Energy Management System has been created and added to the 2023 NEC

- ▲ The Energy Management Task group was asked to review all current and proposed definitions and requirements
- ▲ Items reviewed were load management, load management system, power control system, energy management system, and related terms
- ▲ Need to promote a coordinated approach and understanding throughout the Code
- ▲ An energy management system will contain a monitor, a form of communication equipment, some type of controller and timer, and other devices responsible for monitoring or controlling an electrical load, a form of power production, or a type of storage source

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Article 100 Definitions- Energy Management System

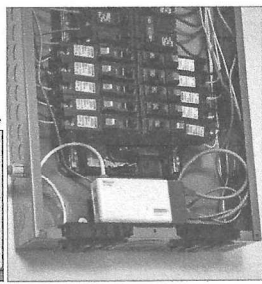
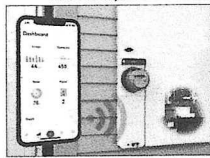
A new definition for Energy Management System has been created and added to the 2023 NEC

A word from Engineer Beth:

An energy management system will contain a monitor, a form of communication equipment, some type of controller and timer, and other devices responsible for monitoring or controlling an electrical load, form of power production, or a type of storage source



Photos courtesy of Schneider Electric



37

Article 100 Definitions- Feeder Assembly

This new definition will provide consistency when referencing the factory cord or cable assembly between the electrical equipment and the mobile home, recreational vehicle, or park trailer panelboard

- ▲ In previous editions of the Code, there were different definitions in the NEC articles under CMP-7 purview that basically covered the power cord assembly
- ▲ Adding the term "feeder assembly" consistently throughout Articles 550, 551, and 552 clarifies that these conductors, although connected to a receptacle, are considered feeders in order to forgo the GFCI protection
- ▲ This alleviates concerns about "unwanted tripping" that could be caused by the accumulation (*multiple portable appliances*) of leakage current at the source

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Article 100 Definitions- Feeder Assembly



Photo's courtesy of RV Upgrades, and IAEI Archives

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Article 100 Definitions- Fibers/Flyings, Combustible

A new definition for "Fibers/Flyings, Combustible" includes 3 informational notes that identify particle size and types of fibers/flyings

- ▲ Part of a Standards Council directive to CMP committees to resolve conflicts among the documents
- ▲ This change is a result of members from several technical committees as part of a Task Group On Combustible Dusts
- ▲ Informational notes following the new definition to include specific information pertaining to combustible metal fibers/flyings

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CMP- 14, Haywood Kines

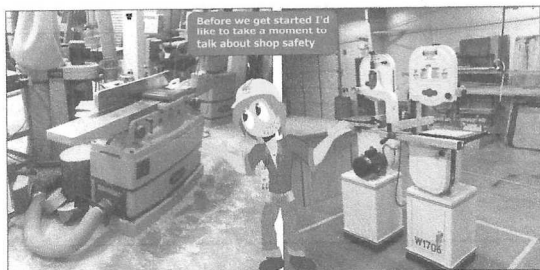
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Article 100- Definitions (Fibers/Flyings, Combustible)

The new definition for Fibers/Flyings, Combustible also includes three informational notes that identify particle size and types of fibers/flyings



41

Article 100 Definitions- Ground Fault

Changed the words from "metallic" to "metal" in the definition of Ground Fault in Article 100

- ▲ Change was made from "metallic" to "metal" to comply with the NEC Style Manual
- ▲ Helps to add clarity and useability by updating the words of the definition
- ▲ This received considerable debate at the NEC Correlating Committee meeting

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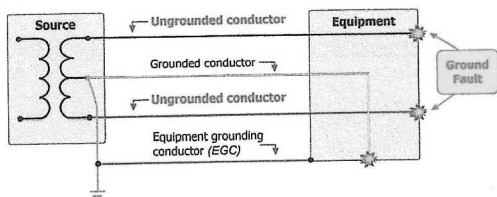
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Article 100 Definitions- Ground Fault



An unintentional, electrically conductive connection between an **ungrounded conductor** of an electrical circuit and the normally non-current-carrying conductors, metal enclosures, metal raceways, metal equipment, or earth.



43

Article 100- Impedance Grounding Conductor

Substantiation was submitted for the creation of a new definition for **Grounding Conductor, Impedance**

- ⚠ There was no definition until the 2023 NEC for a conductor that made a connection between the neutral point for an impedance grounded system and the grounding impedance device
- ⚠ The impedance grounding conductor will carry fault current that has been reduced by a designated impedance
- ⚠ This conductor did not meet the definition of a neutral conductor as it is not intended to carry current under normal conditions
- ⚠ It also did not meet the definition of a **grounding electrode conductor**

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Article 100- Impedance Grounding Conductor

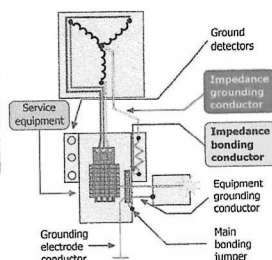
New definition for "**impedance grounding conductor**" was created to replace the phrase "grounded system conductor"

A Word from Engineer Nick

There was no definition until the 2023 NEC

This conductor makes a connection between the neutral point for an impedance grounded system and the grounding impedance device

The impedance grounding conductor will carry fault current that has been reduced by a designated impedance



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Article 100- Impedance Grounded System

Substantiation was submitted for the creation of a new definition for **Grounded System, Impedance**

- ⚠ There was no definition for an **impedance grounded system** before the 2023 NEC code cycle
- ⚠ This resulted in an inconsistent use and understanding of these systems as they applied with high impedance grounded neutral systems and impedance grounded neutral systems
- ⚠ Electrical professionals will have a new definition that is accurate and consistently defines elements that make up this system

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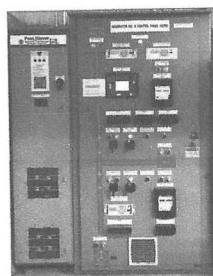
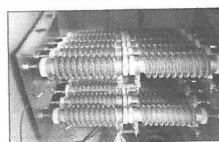
Article 100- Impedance Grounded System

Substantiation was submitted for the creation of a new definition for **Grounded System, Impedance**

Engineer Beth says:

No definition for an impedance grounded system before the 2023 NEC

This resulted in an inconsistent use and understanding of these systems as it applied with high impedance grounded neutral systems and impedance grounded neutral systems



Photos courtesy of Rob Bowman

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Article 100- Impedance Grounded System

Photo shows the typical ground detection and alarm system associated with an impedance grounded system

Has visual as well as audible alarm features

These systems help maintain continuity of power, and are recognized in NFPA 70E as a method of reducing arc flash severity

Manufactured by Post Grover

Photo courtesy of Rob Bowman

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Article 100 Definitions- In Sight From

The definition of "In Sight From (Within Sight From), (Within Sight)" has been modified per requirements of the NEC Style Manual

- ▲ The NEC Style Manual states that definitions shall not contain requirements or recommendations
- ▲ See the new section for "In Sight From (Within Sight From), (Within Sight)" in 110.29 for requirements
- ▲ Definition revised for clarity and uniform enforcement
- ▲ Equipment that is visible and not more than 15 m (50 ft.) distant from other equipment is considered to be in sight from that other equipment

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Article 100- In Sight From (Within Sight From, Within Sight)

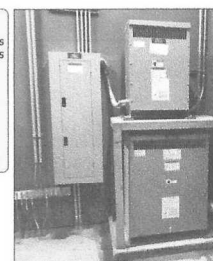
Distance is to be visible and not more than 15 m (50 ft) from the other equipment
(Note: see 110.29 for requirements for In Sight From (Within Sight From, Within Sight))

A Word from Electrician Jeff

Transformer disconnecting means is located in the electrical panel and is labeled

Transformer is labeled as to the panel and branch circuit it is controlled from

Always test for the presence of electricity before beginning the troubleshooting of electrical issues



50

Article 100- Likely to Become Energized

Substantiation was submitted for the creation of a new definition explaining the phrase *Energized, Likely to Become*

- ▲ There was no definition of this phrase that appears 25 times within the NEC
- ▲ Annex B of the NEC Style Manual defines "likely to become energized" as a "failure of insulation on" (Annex B is units of measure)
- ▲ There is a very important distinction between what can become energized compared to what is likely to become energized
- ▲ Likely to become energized was up to interpretation with opinions that differed from jurisdiction to jurisdiction
- ▲ This caused frustration among electrical professionals when applying requirements from the NEC

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Article 100- Energized, Likely to Become

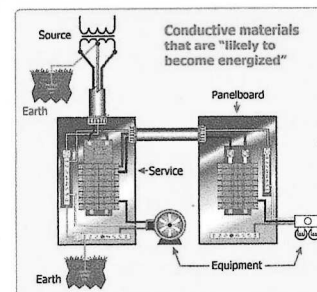
Likely to become energized was up to interpretation with opinions that differed from jurisdiction to jurisdiction

Engineer Nic

Annex B of the NEC Style Manual defines "likely to become energized" as a "failure of insulation on" (Annex B is units of measure)

Definition factors:

- a conductive material
- this conductive material could become energized
- could be due to failure of electrical insulation or electrical spacing



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Article 100- Load Management

Substantiation was submitted for a new definition for *Load Management*

- ▲ Was the result of the Energy Management Task Group asked to review current as well as proposed definitions and requirements
- ▲ Review topics included load management, load management system, power control system, energy management system, and related terms
- ▲ This will result in a coordinated approach and understanding throughout the NEC
- ▲ Task group proposed several public comments for energy management items located throughout the NEC
- ▲ Load management is considered a function of a listed energy management system
- ▲ The definition will now correlate with Article 750, *Energy Management Systems*

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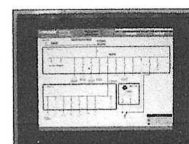
53

Article 100- Load Management

Substantiation was submitted for a new definition for Load Management
Review topics included load management, load management system, power control system, energy management system and related terms

Engineer Beth says:

This will result in a coordinated approach and understanding throughout the NEC
The definition will now correlate with Article 750 *Energy Management Systems*



Square D Load Management Systems



Photo from IAEI Archives

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Article 100 Definitions- Normal High-Water Level

This new definition will help the authority having jurisdiction (AHJ) determine the elevation for the electrical datum plane distances used in Articles 551, 555, and 682

- ⚠ Previously, there was no consistent way to determine the elevation next to a body of water to validate or confirm where electrical equipment could be placed and where the electrical datum plane is located
- ⚠ This will provide an easier and more consistent way to determine the elevation for the electrical datum planes
- ⚠ See this definition for further definitions of the following:
 - ✖ Natural or Artificially Made Shorelines
 - ✖ Rivers and Streams
 - ✖ Flood Control Bodies of Water
 - ✖ Nonflood Control Bodies of Water

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CMP- 7, Dean Hunter

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What is an Electrical Datum Plane?

- ⚠ The electrical datum plane is a horizontal plane, a specified distance above the normal high-water level
- ⚠ It governs, by applicable *Code* rules, the lowest level that specified electrical equipment can be installed, and the electrical connections can be made
- ⚠ One good example is 555.3(A) for floating piers
- ⚠ The electrical datum plane for floating piers and landing stages is installed to permit located to accommodate the rise and fall of the pier or stage in response to water level, without lateral movement
- ⚠ In these cases, the datum plane above the floating pier or landing stage is specified as being 30 inches above the water level at the floating pier or landing stage and a minimum of 12 inches above the level of the deck



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Article 100 Definitions- PV DC Circuit

New terms and revised definitions for PV System DC elements

⚠ PV System Source Circuit and PV String Circuit subsets of a PV System DC Circuit

- ⚠ PV Source Circuit is inclusive of the series and/or parallel dc circuit conductors between the modules and combiners, inverters or PV system dc disconnect
- ⚠ PV String Circuit is inclusive of the series dc circuit conductors between the modules
- ⚠ Previous terms and definitions were difficult to apply to current designs
- ⚠ Decided to clarify these definitions as well as relocate all definitions to Article 100
- ⚠ The definitions relocated to comply with the NEC Style manual requirements

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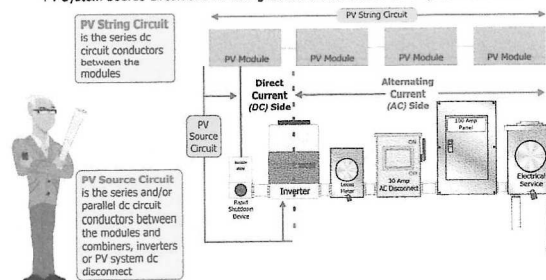
CMP- 4, Pete Jackson

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Article 100- PV DC Circuit

PV System Source Circuit and PV String Circuit are subsets of a PV System DC Circuit



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Article 100 Definitions- Restricted Industrial Establishment

New definition in Article 100 created to align with requirements for installations specifically found within hazardous (*classified*) locations

- ⚠ Resulted in more concise wording in the definition and deleted unnecessary/redundant text for defining an industrial facility
- ⚠ Removed the phrase *"In industrial establishments with restricted public access, where the conditions of maintenance and supervision ensure that only qualified persons service the installation"*
- ⚠ Now states it is an establishment with restricted public access where there are conditions of maintenance where supervision ensures only qualified persons service the installation
- ⚠ The above text was repeated in over 40 subdivisions for wiring methods permitted in hazardous (*classified*) locations
- ⚠ This addressed an NFPA Correlating Committee request for all code panels to reduce redundant text that would not impact the Code requirements

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CMP- 14, Haywood Kines NFPA LINK® iaei.org

61

Article 100- Definitions- Restricted Industrial Establishment

New definition in Article 100 created to align with requirements for installations specifically found within hazardous (*classified*) locations

Resulted in more concise wording in the definition and deleted unnecessary/redundant text for defining an industrial facility

Addressed NFPA Correlating Committee request to reduce redundant text, but not impact code language


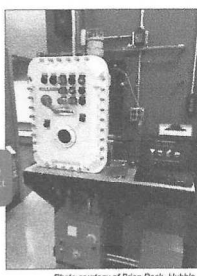



Photo courtesy of Brian Rock-Hubble

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62

IAEI

Article 100 Definitions- Servicing

A new definition for servicing of electrical equipment to assist in maintenance and repair activities

- ⚠ There has been confusion between what is considered reconditioning versus normal servicing, maintenance, and repair of electrical equipment
- ⚠ This definition distinguishes the act of servicing and maintenance of electrical equipment from reconditioning of electrical equipment
- ⚠ It will help assure the operational performance of the electrical equipment during the life of the equipment
- ⚠ See NEMA CS 100-2020, *NEMA Technical Position on Reconditioned Electrical Equipment*, for additional information on the proper application of rules related to reconditioning

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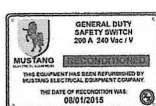
CMP- 1, Paul Sood NFPA LINK® iaei.org

63

Article 100- Servicing

Reconditioning and servicing of equipment is not the same. Switchboards and Switchgear Permitted to be Reconditioned. Definition of "Servicing" helps to explain the difference.

To service equipment means to perform maintenance and repair of electrical equipment. Label shown that has been applied to the switchgear denoting it has also been reconditioned.

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IAEI

Article 100 Definitions- Short Circuit

A new definition for "short circuit" has been added to the Code by CMP-10

- ⚠ Short circuit is used several times throughout the NEC
- ⚠ The definition is added to improve the usability of the code
- ⚠ Previously, the user of the Code had to rely on other industry standards to determine the definition of this term, such as the IEEE 100-1992, *The New IEEE Standard Dictionary of Electrical and Electronic Terms*, 5th Edition

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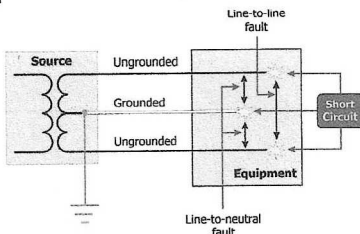
CMP- 10, David Williams NFPA LINK® iaei.org

65

Definition: Short Circuit

Characteristics of a Short Circuit:

- It is a conducting connection
- can exist between any of the conductors of an electrical system
- either from line-to-line or from line to the grounded conductor
- can be accidental or intentional



Random Current (Larry)

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Article 100 Definitions- Storable Swimming, Wading, or Immersion Pools and Storable/Portable Spas and Hot Tubs

The definition was modified removing the 42 in. depth language thus aligning with current product manufacturing standards

⚠ This new definition covers:

- ✎ Storable Swimming, Wading, or Immersion Pools and
- ✎ Storable/Portable Spa and Hot Tub

- ⚠ The previous water depth limitations were based on typical storable pool construction at that time and not related to any electrical hazard associated with water depth
- ⚠ AHJs were placed in a position of identifying a code violation when the 42-in depth was in the previous definitions *(even though there was not an electrical hazard)*
- ⚠ This should eliminate the confusion and unnecessary requirements that an equipotential bonding system be installed

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CMP-17, Donny Cook

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Article 100 Definitions- Storable Swimming, Wading, or Immersion Pools and Storable/Portable Spas and Hot Tubs

I don't know what an equipotential bonding system is but that sounds expensive
- Holly Homeowner

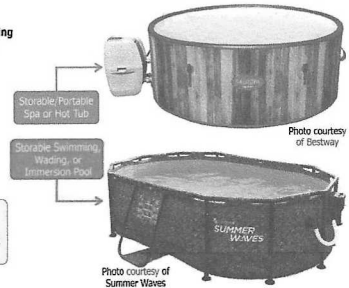


Photo courtesy of Bestway

The 42 in. depth language has been removed
This now aligns with product manufacturing standards

Photo courtesy of Summer Waves

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Article 100 Definitions- Transformer

A new definition for a transformer has been created and added to the 2023 NEC

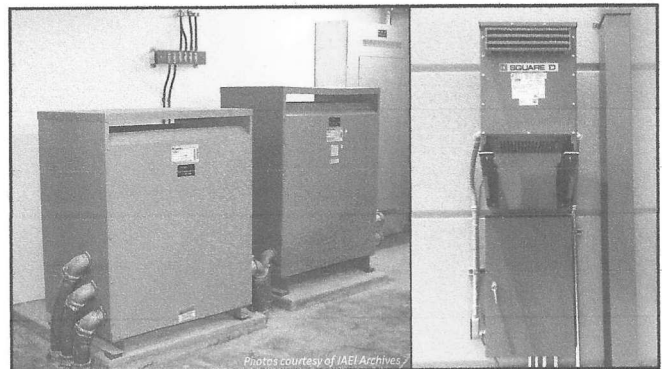
- ⚠ The word "transformer" occurs approximately 1500 times in the NEC
- ⚠ This new definition covers both single and polyphase equipment operating by electromagnetic induction
- ⚠ The definition was careful not to state "changing voltage or current" because isolating transformers filter noise without changing nominal voltages

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IAEI Codes and Standards Committee

NFPA LINK® iaei.org

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Photos courtesy of IAEI Archives

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Article 100 Definitions- Work Surface

A new definition was added to help users of the Code understand what constitutes a "Work Surface" location

- ⚠ There appears to be installer and enforcement confusion as well as frequent product misapplications resulting from electrical equipment being installed incorrectly on these surfaces *(Work surfaces involve lower volumes of spillage than countertops)*
- ⚠ The key distinction between a work surface and a countertop is the quantity of spillage that the surfaces may be subjected
- ⚠ The electrical professional will be directed to the industry standards that aid in the proper application of receptacles in these locations
- ⚠ See Informational Note No. 1 for UL 111, *Outline of Investigation for Multioutlet Assemblies*, and UL 962A, *Furniture Power Distribution Units*
- ⚠ See Informational Note No. 2 for information on receptacles for work surfaces distinguished from receptacles for counters and countertops

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CMP- 2, Joseph Wages, Jr.

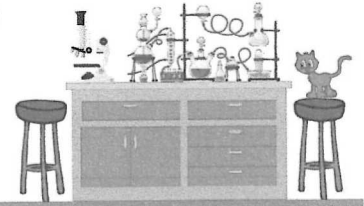
NFPA LINK® iaei.org

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Article 100 Work Surface

New definition due to misapplications resulting from electrical equipment installed incorrectly on these surfaces

The electrical professional needs to consult industry standards that assist with proper application of receptacles
Key difference between a work surface and countertop is the quantity of spillage the surface is subjected



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Lowell Reith

Objective	To work towards providing the training required today, for people to work in the electrical field as a productive and complete employee.		
Work experience	2001-Present:	Interstates Construction Services Inc. Sioux Center IA.	
	Training and Licensing Officer:	In charge of developing a DOL/BAT approved training program for the field electricians. Oversee licensing requirements and provide NEC update classes and provide answers for the field on code issues.	
	1988-2001	North Central KS Tech. College	Beloit, Ks
	Instructor/Department Head Electrical Technology	Was the first year instructor coving the basic theory and wiring methods for students. Moved up to the head of the department and second year instructor in 1992. Have worked with job placement; grant writing, outside jobs that the students worked on. Worked on updating equipment and curriculum for the program.	
	1988-1997	V & V Electric	Manhattan, Ks
		• Was the master electrician for the company. Worked on various residential, commercial, and light industrial projects.	
	1984-1988	Washington County Hospital	Washington, Ks
		• Was in charge of the electrical maintenance in the hospital and also helped maintained the overall building	
	1980-1984	Purser's Electric	Clifton, Ks
		• Worked as an electrician, doing residential and commercial installations. Also took care of the local elevators for their electrical needs.	
	1978-1980	Action Electric	Hanover, Ks
		• Worked as an electrician doing steel elevators. This included wiring the control panels as well as the motors for the grain legs, fans, and associated equipment.	
Education	1996-Present	Pittsburg State College	Pittsburg, Ks
		• I am working on finishing my BS degree in the next couple of years. I am taking classes each semester as my job allows. The rest of my classes do not require me to be on site to finish.	
	1996	Cloud County Comm. College	Concordia, Ks
		• Associates of Applied Science Electrical Technology	
	1978	North Central Ks Vo-Tech	Beloit, Ks
		• Diploma in Electricity	
	1976	Linn High school	Linn, Ks
		• Diploma	
Licenses Held	See List attached:		
Accreditations	Certified as a Vocational Instructor (Electricity) by the state of Kansas (Expired not require By the State to teach at Technical Colleges) Approved as Continuing Ed provider for Nebraska and South Dakota, Idaho, North Dakota, Minnesota, Kansas, Oklahoma, Washington, Wyoming, Wisconsin, Texas, Wisconsin, Iowa, Michigan, and Kentucky.		
Publications	Author of Master Electrician's Exam Workbook 2008, 2011, 2014, and 2017. Published by American Technical Publishers.		
Professional Memberships And Accomplishments	IEAI (International Association of Electrical Inspectors.) NFPA-Electrical Division NFPA 70 Code Making Panel #14 ABC Craft Instructor of the Year Finalist 2017		

Alabama	Electrical Contractor	6/30/2023	2073
Arizona	Qualifier for Contractor's License L-11 600 v or less Comm.	11/30/2024	88555
Arizona	Qualifier for Contractor's License C-11 Residential	10/31/2024	268857
Arizona	Qualifier for Contractor's License A-17 Over 600 v	11/30/2024	ROC249839
Arkansas	Master Electrician	1/31/2023	M-9482
Calif	Journeyman Electrician	7/21/2025	149353
California	Qualifier for Electrical Contractor License	10/31/2023	443221
Colorado	Master Electrician	9/30/2023	5375
Connecticut	Contractor	9/30/2023	ELC0205578-E1
Delaware	Master Electrician	6/30/2024	T1-0005633
FL Polk County	Qualifier for Occupational License	9/30/2023	9970026655
Florida	Qualifier for Contractor's License	8/31/2025	EC13002688
ICC	Commercial Electrical Inspector	5/25/2025	8207866
Idaho	Electrical Contractor	4/30/2023	C-27873
Idaho	Master	4/30/2024	34580
IL Bloomington	Qualifier for Contractor's License	12/31/2022	CR080652
IL Danville	Electrical Contractor	4/30/2022	EA-1975
IL Decatur	Registered Electrician	12/31/2023	EC92-170
IL PEORIA	Master Electrician	12/31/2022	18722
IN Indianapolis	Master Electrician	12/31/2023	E0001496
IN South Bend	Qualifier for Contractor's License	12/02/2023	3290
Iowa	Electrical Contractor	12/31/2025	EL-189 EC
Iowa	Master Electrician	12/31/2025	EL-189 MA
Kentucky	Master Electrician	12/31/2022	ME65076
Kentucky	Contractor	12/31/2022	CE65085
KS Colby	Master Electrician	12/31/2023	EL-22-104
Ks Dodge City	Master Electrician	12/31/2022	16-00002547
KS Emporia	Master Electrician	12/31/2022	3646
KS Hutchinson	Master Electrician	12/31/2022	TR19-000280
KS Junction City	Master Electrician	12/31/2023	L06XX
KS Leavenworth	Master Electrician	12/31/2022	7664
KS Manhattan	Master Electrician	12/31/2023	5388
KS Salina	Master Electrician	12/31/2023	7250
KS Topeka	Master Electrician	12/14/2023	ELMA201907053398
KS Wichita	Master Electrician	12/31/2022	22201
LA Shreveport	Master Electrician	12/31/2023	1001088
Louisiana	Qualifier for Contractor's License	6/30/2023	51627
Maine	Qualifier for Contractor's License	7/31/2024	MC60019917
Maine	Master Electrician	7/31/2024	MS60018939
Maryland	Master Electrician	9/18/2023	13717
Michigan	Electrical Contractor	12/13/2024	6112707
Minnesota	Journeyman Electrician	10/28/2024	AJ14787
Minnesota	Master Electrician	2/28/2023	AM688299
MO Springfield	Master Electrician	12/31/2022	BTC-0007029

MO St Joseph	Master Electrician	8/13/2023	TR-06907
MO St Louis	Master Electrician	3/2/2023	EC#314
Montana	Qualifier for Contractor's License	7/15/2024	273
Montana	Master Electrician	7/15/2024	ELE-EM-LIC-9573
MT Great Falls	Master Electrician	12/31/2022	08-17800
Nebraska	Electrical Contractor	12/31/2024	52
Nebraska	Journeyman Electrician	12/31/2024	7993
Nevada	Qualifier for Contractor's License	7/31/2024	65027
New Hampshire	Master Electrician	12/31/2023	12564 M
New Jersey	Electrical Contractor	3/31/2024	34EI01628700
New Mexico	Electrical Contractor	10/31/2025	91159
NY Dunkrick	Master	12/31/2022	77-2021
North Carolina	Qualifier for Contractor's License	5/4/2023	25678-U
North Dakota	Master Electrician	4/30/2023	M 2824
Ohio	Electrical Contractor	1/4/2023	44756
Oklahoma	Electrical Contractor	12/31/2023	100713
OK Eufala	Electrical Contractor	6/30/2023	1053
Oregon	Qualifier for Contractor's License	3/1/2024	72081
Oregon	General Supervising Electrician	10/1/2025	5425S
PA Philadelphia	Qualifier for Contractor's License	6/28/2023	18006
South Carolina	Qualifier for Contractor's License	7/31/2024	M107251
South Carolina	Qualifier for Fire Alarm Systems License	7/31/2024	FAC.3430M
South Dakota	Electrical Contractor	6/30/2024	EC 2593
South Dakota	Master Electrician	6/30/2024	2593
Tennessee	Qualifier for Contractor's License	5/31/2023	758358
Texas	Master Electrician	6/21/2023	126213
Utah	Qualifier for Contractor's License	11/30/2023	231090-5501
Utah	Master Electrician	11/30/2024	5535294-5502
Vermont	Master Electrician	6/30/2024	EM-5119
Virginia	Master Electrician	05/31/2025	2710066661
Washington	General Administrator	12/13/2023	REITHL*911C7
West Virginia	Qualifier for Contractor's License	2/2/2023	WV41954
Wisconsin	Master Electrician	6/30/2024	1357606
WY Cheyenne	Master Electrician	5/6/2023	CT-12-25381
WY Laramie	Master Electrician	12/31/2022	808M
Wyoming	Master Electrician	7/1/2024	M-21533
	NICET Fire Alarm	7/1/2024	116527

Keith Bunger

Address: 308 Brookway Dr.
Manhattan, KS 66502
Phone: (785) 650-1018
Email: bunger07@hotmail.com

Objective

Obtain a career in the electrical trade that utilizes my strong work ethic, communication skills, and knowledge of electrical systems.

Skills

- Well-rounded
- Reliable
- Troubleshooting
- Motor Controls
- Computer Literate
- Diligent

Certifications

- Kansas Journeyman Electrician License
- NCCER Master Trainer
- NCCER Craft Instructor Certified
- OSHA 10 – Feb 2018
- CPR / First Aid – Feb 2018
- Nebraska and Iowa Apprentice Electrician License

Education

Pittsburg State University, Pittsburg KS

Bachelor of Science in Vocational – Technical Education, May 2015

North Central Kansas Technical College, Hays KS

Associate of Applied Science in Electrical Technology, May 2011

OSHA 10 Certified, September 2009

Work Experience

Interstates Construction Services, Sioux Center IA – (June 2017 – Present)

Technical Instructor

- Train apprentices through the NCCER Electrical curriculum
- Instruct new hires how to work safely in industrial environments
- Train new hires to various company policies; Fall Protection, Lift Training, LOTO, Energized Work, Safety Training, Best Practices
- Demonstrate the basic operations on Instrumentation; Operation, Wiring, Communications

North Central Kansas Technical College, Hays KS – (August 2011 – July 2017)

Electrical Technology Instructor

Courses include

- Commercial Wiring Methods, different lighting systems and wiring methods
- Transformers, single and three phase systems
- Troubleshooting; residential, commercial, and industrial circuits
- Industrial Motor Controls, basic components and common wiring methods
- Programmable Controllers, Allan Bradley PLC's Micro Logic and Compact Logic
- Understanding the National Electric Code

Heineken Electric, Salina KS – (Summer of 2016)

Apprentice Electrician

- Commercial Wiring
- Bend and install EMT conduit
- Install receptacles and low volt switching
- Test lighting circuits
- Install panels and transformers

Kramer Electric, Hays KS – (Summer of 2010)

Apprentice Electrician

- Residential Wiring
- Commercial Wiring
- New construction and remodel
- Run wiring and conduits
- Install fixtures and devices
- Test and troubleshoot circuits

References

Available upon request.

NCCER

Board of Trustees confers upon

Keith Bunger

this certification for

*Craft Instructor
Electrical*

as part of the National Craft Assessment & Certification Program
on this Sixteenth day of February, in the year 2018



Donald E. Whyte

Donald E. Whyte
President, NCCER

Travis Andersen

Interstates

Construction Services

Craft Trainer

Andersen Electric Inc.

Owner/President

Interstates

Construction Services

Sioux Center, IA 51250

(712)722-1661

Travis.andersen@interstates.com

Andersen Electric Inc.

950 4th Ave NW

Sioux Center, IA 51250

(712)441-7141

Andersenelectricinc@hotmail.com

OBJECTIVE

I am Dedicated to the Electrical field. Wanting to get involved deeper into the field/industry and work to make it better for those who follow. You should never stop challenging yourself or educating yourself in your field/industry. I believe very strongly in this Theodore Roosevelt Quote.

" Every man owes a part of his time and money to the business or industry to which he is engaged. No man has a moral right to withhold his support from an organization that is striving to improve conditions within his sphere."
Theodore Roosevelt

EXPERIENCE

5/1/1997 – 9/1/2007

Sorlien Electric Inc.

Tea, SD 57064

(605)368-7371

Journeyman Electrician

9/1/2007 - Present

Andersen Electric Inc.

Sioux Center, IA 51250

(712)441-7141

Owner/Contractor

10/1/2016 - Present

Interstates Construction Services

Sioux Center, IA 51250

(712)722-1661

Craft Trainer

EDUCATION

8/1996 – 5/1998

Northeast Community College

Norfolk, NE 68702

(402)371-2020

Associates- Electrician

Residential/Commercial

Experiences

Licensed Electrical Contractor in South Dakota

Licensed Electrical Contractor in Iowa

Licensed Electrical Contractor in City of Sioux Falls, SD

Northwest Iowa Electrical Association (NIEA) Board Member

South Dakota Electrical Council (SDEC) Member

Northwest Iowa Community College Advisory Committee

Hope Lutheran Church Council/ Stewardship Team/ Vision Team

BBB Accredited Business, A+

Sioux Center Chamber of Commerce

Dale Carnegie Leadership Training

NCCER approved Craft Instructor / Electrical

State of Iowa approved CEU Instructor

REFERENCES

Lowell Reith, Training & Licensing Officer Interstates Construction Services, (712)441-5097

Tor Sorlien, owner Sorlien Electric Inc., (605)368-7371

Byron Krull, Instructor Northwest Community College, (712)324-5061

Tim Mantel, Sales Echo Group Inc., (712)722-2808

NCCER

Board of Trustees confers upon

Travis Andersen

this certification for

Craft Instructor
Electrical

as part of the National Craft Assessment & Certification Program
on this Sixteenth day of February, in the year 2018



Donald E. Whyte
Donald E. Whyte
President, NCCER



ALLAN HILL

1117 1st Ave. Sioux Center, IA 51250 · 785-650-1535
Allan.hill@intertstes.com

To work for a company that trains electricians the proper way and safe way to install electrical systems.

EXPERIENCE

MAY 2019 – PRESENT

TECHNICAL INSTRUCTOR, INTERSTATES

Train new hire employees the Interstates safety, conduit bending and threading methods, Isometric drawings, and lockout/Tag out Procedures. Work with the apprentices in their training throughout the apprenticeship program.

AUGUST 1998 – MAY 2019

ELECTRICAL INSTRUCTOR/DEPARTMENT CHAIR NORTN CENTRAL KANSAS TECHNICAL COLLEGE

Teach new students how to be an electrician. This include lecture, lab assignments. Courses taught: AC/DC Theory, Residential Wiring, National Electrical Code, Commercial wiring, and Safety

JUNE 1992 – AUGUST 1998

APPRENTICE/JOURNEYMAN ELECTRICIAN, HAYNES ELECTRIC

Started by being an apprentice electrician with wiring of commercial and residential building. Then moved up to a journeyman electrician that was in charge of running the project from start to finish. Organizing work that need to be completed and working with other contractors on site.

EDUCATION

DECEMBER 1996

BACHLORS OF SCIENCE IN TECHNICAL EDUCATION, PITTSBURG STATE UNIVERSITY

It's okay to brag about your GPA, awards, and honors. Feel free to summarize your coursework too.

MAY 1993

CERTIFICATE IN ELECTRICAL TECHNOLOGY, PITTSBURG STATE UNIVERSITY

It's okay to brag about your GPA, awards, and honors. Feel free to summarize your coursework too.

SKILLS

- NEC code knowledge
- List one of your strengths

- Public speaking

- List one of your strengths
- List one of your strengths

ACTIVITIES

I enjoy going to dirt track races in our area. I also enjoy going fishing and camping in my free time.

NCCER

Board of Trustees confers upon

Allan Hill

this certification for

Craft Instructor
Electrical

as part of the National Craft Assessment & Certification Program
on this Second day of July, in the year 2019



Donald E. Whyte

Donald E. Whyte
President, NCCER



Certificate of Completion

Example

Has successfully completed this course and has earned 8 hours of
continuing education credits

NEC 2023 Code Update

SD - Course #:

License #:

CLASS LOCATION: Sioux Center, IA

DATE: Nov 10, 2022

INTERSTATES

INTERSTATES, INC.
1400 7th Ave NE, SIOUX CENTER, IOWA 51250

Lowell Reich

State _____

I hereby certify that the persons listed above attended the presentation of the educational program identified above.

Date _____