PEG PROTECTION ENGINEERS GROUP

atis

National Electrical Code (NEC) Update

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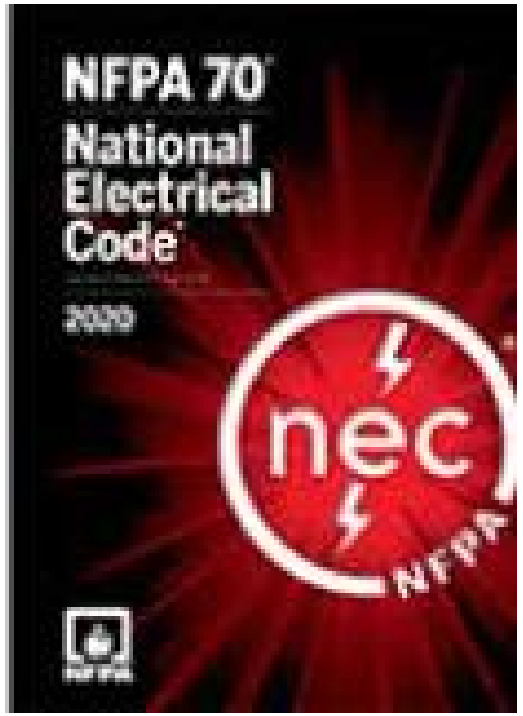
Network Infrastructure Solutions - Ericsson

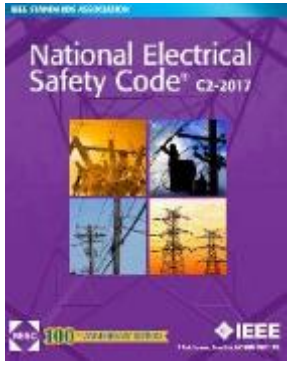
Sponsored by: SNC, HUBBELL, BURNDY, nVent ERICO, HARGER, SETsafe, SET fuse

Session 2: *Grounding for GPR and Lightning Remediation*

March 17, 2022

Codes in Context





National Fire Protection Association
The authority on fire, electrical, and building safety

IEEE
Advancing Technology for Humanity

RULES
for
Overhead Electric Line Construction

California Public Utilities Commission

PUBLIC UTILITIES COMMISSION

- **Industry Safety Codes and Standards**
- **Regulatory Rules…… Legal Mandates**
- **Internal Practices……Engineering Design**

- **NFPA – NEC & NFPA 70E**
- **IEEE NESC**
- GO-95….GO128….GO165
- OSHA 1910.268/269
- Internal M&Ps
  - GRs and UL Listings
- Joint Use Agreements (JUA)
- UL
- GRs/SRs
- ATIS
- etc……

Purposes and Scope

Inside and On Buildings → NEC

Purpose = The practical safeguarding of persons and property from hazards arising from the use of electricity

- NFPA = Fire Protection

Scope – covers installation of electrical and communications (electrical and fiber optic) conductors, equipment and raceways, for

- Public & private premises (homes, residences, buildings, similar properties) … inside
- Focus is on load side of the demarcation point
- Out of Scope (Exemption) = Exclusive control of Utility (Communications, Power….)

Not a Design Manual

OSP → NESC

Purpose = The practical safeguarding of persons, utility facilities, and affected property during the installation, operation, and maintenance of electric supply and communication facilities.

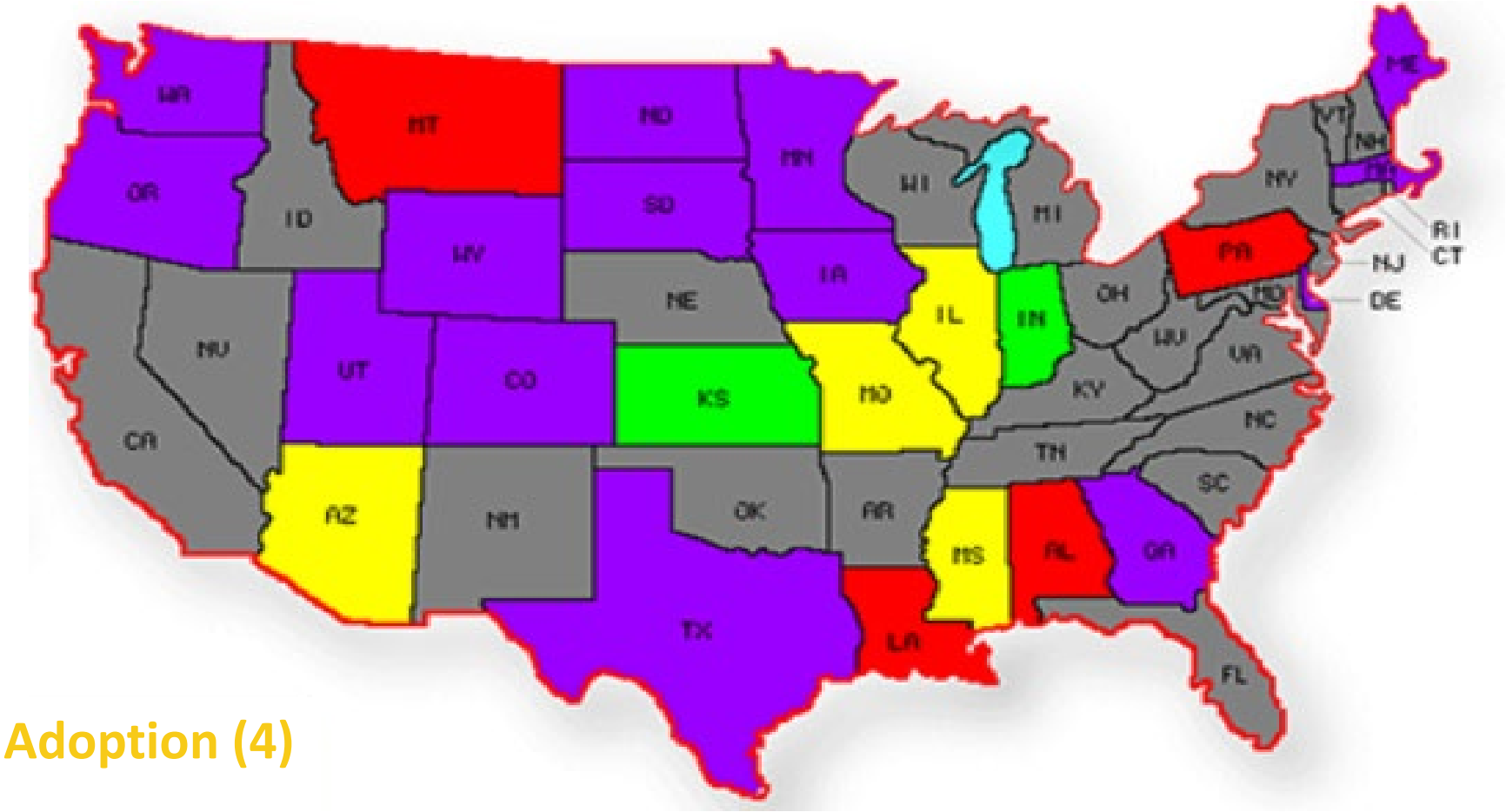
- IEEE = Electrical Safety of Public and Workers

Scope - covers supply and communication facilities and associated work practices employed by a electric supply, communications, or railway in the exercise of its functions as a utility.

- Facilities = lines, equipment, and specified infrastructure (e.g., poles, distribution plant sub-stations, vaults…)
- The NESC covers similar systems under the exclusive control of the utility and being worked by qualified persons, such as those associated with an industrial complex or utility interactive system.

Not a Design Guide or Instruction Manual

NEC Adoption as of 1/1/2022



2020 (14)

2017 (26)

2014 (4)

2008 (2)

Local County Adoption (4)

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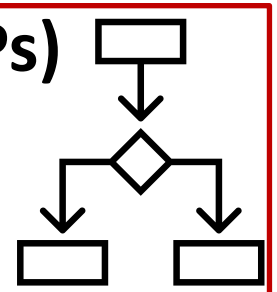
NEC (NFPA 70) Representation

Correlating Committee (CC) and 3 NEC Technical Committees (CMPs)



- **CMP 1** – Purpose and Scope (Arts. 90, 100 and 110)
- **CMP 5** – Grounding (Arts. 200, 250, 280 and 285)
- **CMP 16** – Communications Systems (Arts. 770, 800-through-840)
- **NEC ACC** - Oversight responsibility for the entire Code-making process, i.e., ensuring due process and correlating technical committee actions

[Monitor and track other CMPs and Articles as needed – e.g., CMP 13 (Article 480 - battery systems), CMP 3 (Article 725 - Class 2/3 circuits, 722 – Class 4 (FMPS) circuits, 726 Class 4 Systems, Chapter 9 tables), CMP 4……]

NEC Schedule with Pandemic Modifications

- Code Making Panels (CMPs) First & Second Draft Meetings
  - **All Virtual**
  - More frequent and extensive Task Group Meetings used prior to formal meetings
- Formal Ballots from CMP Meetings – Feb-March 2021…. Dec 2021-Jan 2022
- Joint Face-to-face/Virtual CC Meeting February 8-10, 2022
- Second Draft Report Posting Date: March 21, 2022
- Targeted publishing date remains August 2022 for the 2023 NEC

General Global Observations and Discussions

- Editorial - Extensive editorial, grammatical, format and style changes made to the NEC to meet the new "*NEC Style Manual*". Code users will see many word, format and sentence structure changes that to do not change the technical intent of the rules.
- Definitions – The consolidation of ALL ~800+ definitions in Article 100 created multiple definitions for the same or similar terms that will need harmonization and consolidation in next cycle.

Scope and Purpose (CMP 1)

Scope and Purpose rearrangement - Considerable reformatting and rearrangement of the scope and purpose sections of the NEC - Sections 90.1, 90.2, 90.3 for style reasons

- No technical changes - however, these changes to oft-cited rules may prove confusing
  - From a communications perspective, they are inconvenient since cross references in internal training and guideline documents will need revision
- The exemption and independence of chapter 8 remain in the 2023 NEC
- Communications utility exemption - the old 90.2B4 has now become 90.2D4
- Independence of Chapter 8 is maintained in Section 90.3

Proposals to remove the independence in 90.3 were rejected because of our presentations to CMP1 and the reorganization of Chapter 8 helped to address any perceived clarity and use-ability concerns.

Consolidations in Chapter 8 Validated (CMP 16)

Chapter 8 was strengthened by revisions to consolidate common requirements for communications cables into Article 800 leaving specific details for specific cable types and installations within the subtending articles

- 800 - General communications cables
  - 805 - Twisted Pair
  - 810 - Radio
  - 820 - Coaxial cabling - CATV type installations
  - 830 - Network-powered Communications Cabling
  - 840 - Premises-Powered Communications Systems

  Article 770 - Fiber optic cables – remains key article for fiber optic cables
- On balance these changes should be positive for communications industry

Chapter 7 Additions and Changes Adopted (CMP 3)

Addition of Class 4 (FMPS) systems and rationalization for Limited Power Circuits

- Article 722 on Cables for Power-Limited Circuits, Fault-Managed Power (CL4) Circuits, and Optical Fiber - general article taking common requirements and related parts from 725, 760 and 770
- Article 724 on Class 1 circuits limited to below 30 volts and 1000VA – was revised to clarify that remote-control and signaling circuits belong in Article 725 and 300.26 and to clearly distinguish between Class 1 and the Class 2 & 3 circuits
- Revised Article 725 on Class 2/Class 3 circuits - modifies original Article 725 to better focus on Class 2 and Class 3 circuits.
- Article 726 - Class 4 Power Systems = new article to cover fault-managed power systems that is one new powering architecture being considered for 5G wireless facility deployments.
- Article 770 - Fiber optic cables – remains key article for fiber optic cables and which remains parallel with related communications cable rules in Chapter 8

Article 726 – Class 4 Power Systems

1. Class 4 is different than Class 2 or Class 3 Limited Power Systems (LPS).
2. These Class 4 systems do not limit the output of the power source but rather the systems limit the energy and power available during a fault condition or event, including human contact, arcing and resistive faults.
3. If monitored and controlled correctly, Class 4 can be as safe or safer than an LPS, but because they are fault-limiting rather than source-limiting, these systems need to be treated differently in the NEC and in product standards.
4. In Class 4 circuits, risks are mitigated by limiting exposure times (short pulses or fast shut-off times) and eliminating repetitive impulses.
5. The Class 4 Power System is a fault-managed system that relies on an electronic handshake to verify that the powered device is present and operating correctly before greater than Class 2 power is applied. Faults result in rapid (milliseconds) termination of output power

Revised 800.48 and 800.3

- CMP 16 - New definitions for communications circuit and communication utility along with new/revised Sections 800.3, 800.48, 800.47 taken together clarify when an installation belongs in Chapter 8 and when it belongs in Chapter 7.
- New 800.48 explicitly delineates the various transition points in Chapter 8 such as "*point of entrance*", "*point of grounding*", "*point of attachment or termination*" , "*point of attachment of the NIU*", and "*service provider demarcation point*".
- Each of these transition points have own unique requirements defined in the subtending articles other Chapter 8 and need to be kept separate since not all installations have all these different transition points.
- The 50-foot criteria for extending the point of entrance is also clarified by this new 800.48 and in the Article 100 definition of Point of Entrance.
- The scopes of the NEC and Chapter 8 are defined under Section 90.2 and the scope statement of 800.1 and 800.3, along with the definitions of communications circuit and broadband. NEC rules apply before and after the demarcation point.

New 800.48 Unlisted Cables Entering Buildings

Unlisted outside plant communications cables and unlisted outside plant CATV-type coaxial cables shall be permitted to be installed in building spaces other than risers, ducts used for environmental air, plenums used for environmental air, and other spaces used for environmental air if all of the following applies:

(1) The length of the cable within the building, measured from its point of entrance, does not exceed 15 m (50 ft).

(2) The cable enters the building from the outside.

(3) The unlisted outside plant communications cable is terminated in an enclosure or on a listed primary protector, or the unlisted outside plant CATV type coaxial cable is terminated at a grounding block.

The point of entrance shall be permitted to be extended from the penetration of the external wall, roof, or floor slab by continuously enclosing the entrance cables in rigid metal conduit (RMC) or intermediate metal conduit (IMC) to the point of emergence.

Informational Note No. 1: Splice cases or terminal boxes, both metallic and plastic types, are typically used as enclosures for splicing or terminating communications cables.

Informational Note No. 2: This section limits the length of unlisted outside plant cable to 15 m (50 ft) from the point of entrance, while 805.90(B) requires that the primary protector be located as close as practicable to the point of entrance of the cable. Therefore, in installations requiring a primary protector, the outside plant cable may not extend 15 m (50 ft) into the building if it is practicable to place the primary protector closer to the point of entrance

Open Issues based on Correlating Committee discussions

- Two defeated Proposals will return
  - Definition of “Communications Service Point”
  - Proposed new 800.40
  - Best strategy may be to create a definition of "Communications Service Point" and modify the new 800.48 to help clarify where this service point is and is to be used as a demarcation point. The creation of a defined term "Communications Service Point" alone could quieten attacks on the independence of Chapter 8.

- Chapter 7 and 8 - location and independence of these articles and sections will continue to arise (application of Section 90.3)

Grounding Highlights - CMP5/CMP16

- Intersystem Bonding Terminations (IBT) 250.94 rules clarified
- Copper-Clad Steel Grounding Conductors - Chapter 8 in 800.100A2 and 810.21A has permitted uses under "*other corrosion-resistant conductive material*" language for communications applications
  - Article 250 does not permit these conductors for grounding of ac power circuits
- Use of Water Piping as Grounding Means for communications applications relegated to least preferred in list for communications purposes.

Other Highlights

- CMP 16 - Harmonization between NEC and NESC has been maintained for the service drop cables and outside (OSP) plant equipment that provide communications services to customer premises.
- Definitions - Nominal Voltage - competing definitions all contain "…*The operating voltage of the cell or battery may vary above or below this value*" which covers communications industry needs.
- Energy Storage Systems - Batteries – Updates to Article 480 deals with stationary standby batteries used to support dc loads and UPS systems serving communications equipment and services.

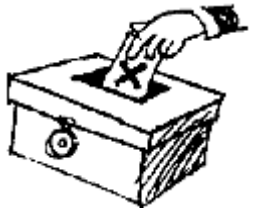
Other Highlights

- A submission by Bill McCoy to revise the definition of Utility was heavily discussed at the fall forum. The definition does not greatly impact NFPA 76 Standard for the Fire Protection of Telecommunications Facilities, but it is being used as a starting point to better address utility exemptions in NFPA 70 NEC. The NEC has exemptions for certain utility installations but never defines what constitutes a utility.

Ongoing Interactions

State Adoptions-------AHJ discussions

Local Variations in Regulations……..Harmonization with NESC/Other Codes



March 2022
CC Ballot

June 2022
Standards Mtg
NITMAN?

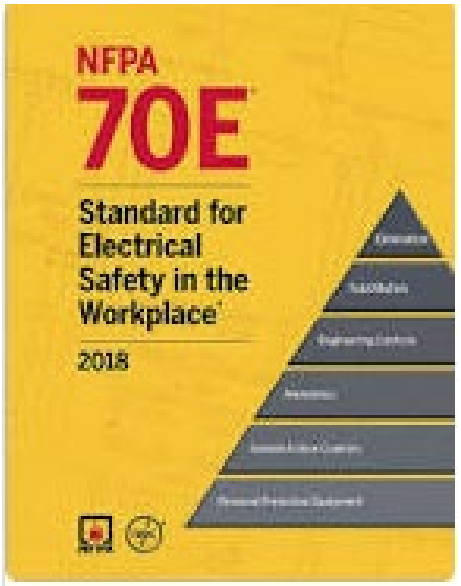
August 2022
NEC 2023 issued

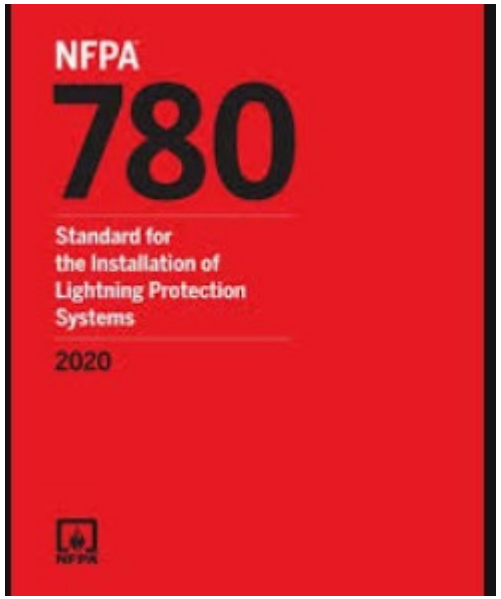
Design – Engineering
Operational M&Ps

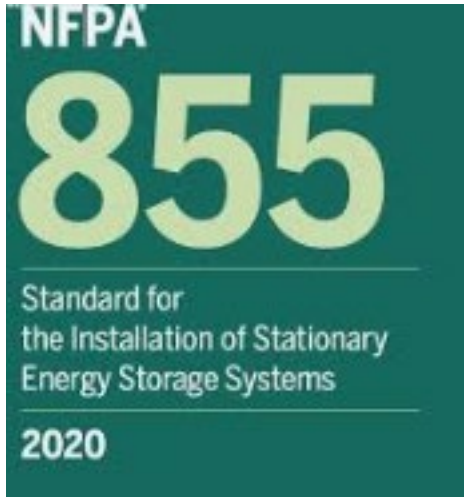
Product Listings

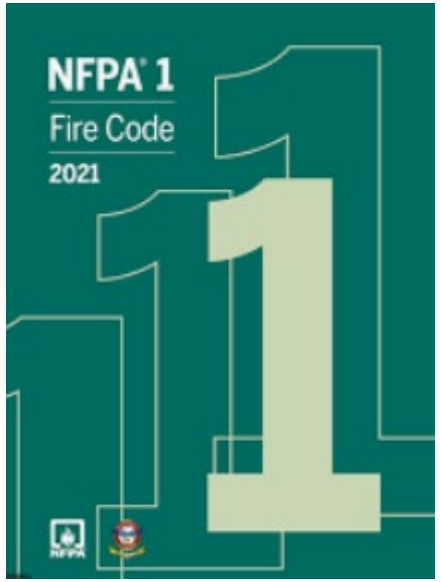
Industry Standards --
Functional Performance
Specifications
GRs, ATIS,…

RELATED INDUSTRY EFFORTS









RELATED INDUSTRY EFFORTS - EXAMPLES

- GR-1089 – EMC ……GR-63/GR-3108/GR-3171/GR-3178 – Inside Equipment
- UL Listing of Telecommunications Equipment and Devices
- GR-513 – Powering
- ATIS Technical Report 0600040 Fault Managed Power Distribution Technologies – Human Contact Fault Analysis
- 0600013 - Electromagnetic Compatibility (EMC) and Electrical Protection
- 0600315 - Voltage Levels for DC-Powered Equipment Used in the Telecom Environment
- 0600318 - Electrical Protection Applied to Telecom Network Plant at Customer Entrances
- 0600337 - Maximum Voltage, Current, and Power Levels Used in Communications Circuits
- 0600338 - Electrical Coordination of Primary and Secondary Surge Protection