



# Update on Safety Codes National Electrical Code (NEC) National Electrical Safety Code (NESC)

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Contact:

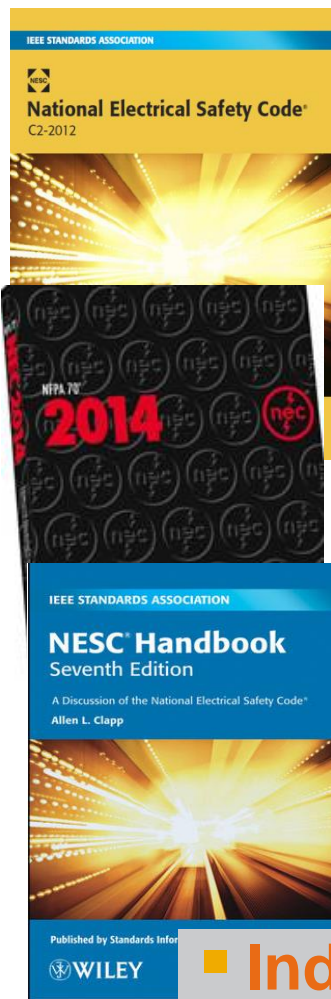
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# Summary

- **Code Overview**
  - **NEC** – by CMP & Article/Section Number
  - **NESC** – by SC & Rule number
  
- **Concerns & Issues**
  - NEC Exemption .... Demarcation Points
  - Mechanical Execution of Work
  - NEC Article 840 expansion
  - Emergency Power Off (EPO) .... Disconnecting Means
  - Bonding & Grounding – Intersystem and on Joint-Use Structures
  - Congestion on Poles and in Buried locations
  - Aerial – Clearances..... Pole Loading and Strength
  - Work Rules.... OSHA ... Tests and Inspections
  
- **Plans and Paths Forward - 2015/2016**
  - Comments to NEC and NESC
  - Other Means for Achieving Safety & Reliability

# Trevor's Adventures in Code Land



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



**California Public Utilities Commission**

Overhead Electric Line Construction



Prescribed by the  
PUBLIC UTILITIES COMMISSION

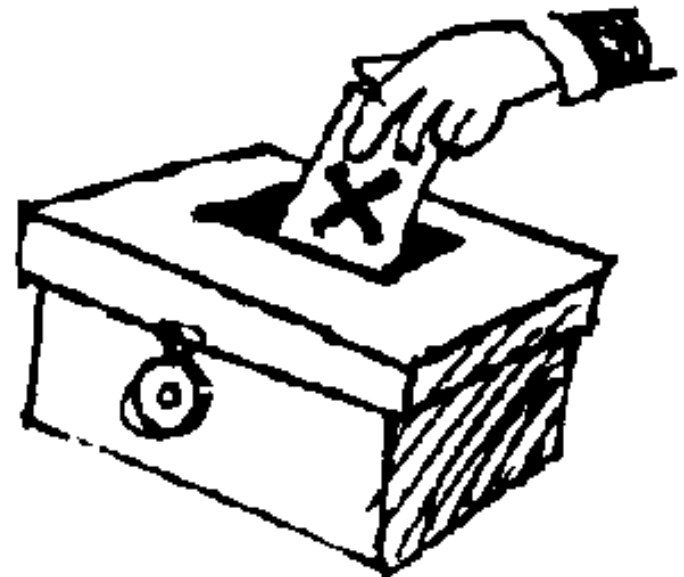
- **IEEE – NESC**
- **NFPA -- NEC**
- GO-95.. GO-165
- OSHA
- Internal M&Ps
  - GRs and UL Listings
- Joint Use Agreements (JUA)
- UL
- GRs/SRs
- ATIS
- etc.....

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

# → Caveats

Remember – we are

1. Half way through both NEC and NESC revision processes
2. Technical positions mostly firm
3. Active Balloting for NEC changes
4. There is still the possibility, if not good probability for some issues, of change.



# Purposes and Scopes

## 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
- Load side of the demarcation point
- Not a Design manual
- Out of Scope (Exemption) = Exclusive control of Utility (Communications, Power....)

## 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 substations, 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

# Revision Process

## NEC = NFPA 70

- **3-year** revision schedule
- National **Fire** Protection Association
- Code-Making Panel (CMP)
- Correlating Committee (CC)
- Public Inputs (PIs) = change proposals
- Public comments on CMP actions
- 2014 Edition (released Sept 2013)
- Change proposals Oct/Nov 2014
- CMP action on proposals, Jan 2015
- We are here 
- Now = CMP Ballots... CC actions
  - **Panel requires 2/3 vote**
  - Recirculates ballot
- Comments – Aug/sept 2015
- CMP action on comments, Nov. 2015
- Final Draft April 2016
- Release of 2017 Code = August 2016
- Applies on adoption by PUC, State legislative or local AHJ bodies

## NESC = IEEE C2

- **5-year** revision schedule
- IEEE - Institute **Electrical & Electronics** Engineers
- Technical Subcommittee (SCs)
- Correlation – SC1 and Standards Committee
- Public change proposals (CPs)
- Public comments (CMs) on SC actions on CPs
- 2012 Edition (released Sept 2011)
- Change proposals deadline = July 2013
- SC action on proposals, Sept 2013-May 2014
  - **Majority vote (51%) sufficient**
- 2017 Preprint = Sept. 2014
- We are here 
- Public Comment deadline = May 1<sup>st</sup> 2015
- SC action on comments, Aug. – Oct 2015
- Final Draft January 2016
- **ANSI Approval – January to May 2016**
- Release of 2017 Code = August 2016
- Applies on adoption by PUC, State legislative or local AHJ bodies

# Revision Process

- NEC = Public Input (PI) → First Revision (FR) → Public comment → 2nd Revision
  - Several Thousand PIs – average of 250-350 per CMP across the 19 CMPs
  - New process this cycle ... More Electronic Process... More Pre-Meeting Task groups
- NESC = Change proposal (CP) → Preprint → Public comment (CM) → 2017 Draft
  - 750-800 CPs across 7 subcommittees
- Multi-step processes = Open processes with several Public and Internal reviews
  - Initial Meeting Vote (majority)
  - Formal Ballots (NEC requires 2/3 vote and has recirculation ballots)
  - NEC has NITMAN Final Appeal/Motion process
  - NESC has ANSI review... NEC does not
  - Initial Change proposals or public inputs often set tone and direction of code
  - Each code has an Appeals process
  - Adoption Variations – State by State, PUC and AHJ inputs
- Next Major steps of interest
  - NEC 2017 Edition
    - Comment deadline = Sept Oct 2015 → Panel meetings = November 2015
  - NESC 2017 Edition
    - Comment deadline = May 1<sup>st</sup> 2015 → Subcommittee meetings = Aug/Sept/Oct 2015

# Relevance

- **NEC** - Adopted by municipalities and other Authorities Having Jurisdiction (AHJ)
  - Unlike voluntary standards, the NEC<sup>®</sup> carries the force of law
  - Used by electrical inspectors to approve electrical and communications installations
  - Impacts daily activities of communications utilities in providing communications services as well as manufacturers providing communications products.
  
- **NESC** - Adopted by most States and municipalities through legal process after a review
  - Legislation – automatic or deliberate adoption
  - PUC regulation
  - Some states do piecemeal adoption – e.g., all except Part 4, adoption to latest code may be delayed by legislative or PUC review
  - Some States have separate independent codes – e.g., GO95 (California)
  - Used as basis of Joint Use Agreements, Intercompany Contracts and Pole Agreements between Utilities
    - Contractual Basis





# NESC 100 Year Anniversary



- <https://standards.ieee.org/about/nesc/100/index.html>
- Keep the NESC active, real and useful for the next 100 years .
- Review of the scope, purpose and operating procedures to help position the code for the new networks and technologies to come

## **NESC Summit – The National Electrical Safety Code (NESC): Past, Present, and Future**

**April 28-29, 2015 - Hilton Alexandria Old Town, Alexandria, VA**

- [http://standards.ieee.org/news/2015/nesc\\_summit.html](http://standards.ieee.org/news/2015/nesc_summit.html)
- Summit Objectives are to:
  - Raise awareness of NESC to relevant stakeholders, including government, industry (non-utility), trade associations, other;
  - Raise awareness/inform of the importance and value of NESC to utilities and the public;
  - Seek input on the future direction of the NESC – to increase use, scope and relevance of the NESC code
    - Scope & purpose issues
    - Procedural matters
      - 5-year cycle versus 3-year cycle
      - Breaking up code into logical parts with different revision cycle frequencies

# ATIS Representation

- Greatest interest and potential impact to communications industry -

## NEC = NFPA 70

### Correlating Committee (CC)

#### 3 NEC Panels (CMPs)

- NEC 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, 810, 820, 830 and 840),
- NEC CC - Oversight responsibility for the entire Code-making process, i.e., ensuring due process and correlating the actions
- Monitor other Panel/Actions – Panel 12 (Article 645)
- Related work on other NFPA Standards 70E, 72, 75 and 76

## NESC = IEEE C2

### C2 Standards Committee

#### 6 of the 7 NESC Subcommittees

(not on substations SC 3)

- SC1 – Purpose, Scope definitions
- SC 2 – Grounding (Rules 09....)
- SC 4 – Aerial Clearances (Rules 20-23)
- SC 5 – Strength/Loading (Rules 24-26)
- SC 7 – Underground/Buried (Rules 30-34)
- SC 8 – Work Rules (Part 4 - Rules 40-44)
- C2 Standards Committee - Oversight responsibility for the entire Code-making process, i.e., ensuring due process and correlating the actions
  - ANSI review
  - Interpretation Requests

# Highlights from the NEC Meetings



# NEC Code Arrangement - 1

## ■ Code Arrangement

- Introduction and nine chapters
  - Article 90, *Introduction*
    - Purpose, Scope and Code Arrangement
      - Section 90.2(B)(4), 'Exemption'
      - Section 90.3, 'Independence' of Chapter 8
  - Chapters 1 through 4 apply generally
    - Electrical installations, wiring and protection, grounding
      - Article 100, *Definitions*
      - Article 250, *Grounding and Bonding (250.94 Intersystem Bonding)*
  - Chapters 5 through 7 apply to special occupancies, equipment
    - Elevators, IT equipment, fire alarm systems, data centers
    - Article 645 Information Technology Equipment



# NEC Code Arrangement - 2



- Code Arrangement (cont'd.)
  - **Chapter 8, *Communications Systems***
    - Article 800, *Communications Circuits* (wire-line telephone)
    - Article 810, *Radio and Television Equipment*
    - Article 820, *CATV and Radio Distribution Systems*
    - Article 830, *Network-Powered Broadband Communications Systems*
    - Article 840, *Premises-Powered Broadband Communications Systems* (**Broadened during 2017 cycle**)
    - Independent of Chapters 1 -7, except where requirements are specifically referenced within Chapter 8
  - Chapter 9 consists of tables that are applicable as referenced
    - Conduit fill, conductor properties, **power source limitations**

# CMP 1 Activities - NEC Proposal Meetings

## ■ Article 90 *Introduction*

- PIs submitted did not directly challenge or change the important provisions for communications systems
  - **Section 90.2(B)(4)** - facilities under exclusive communications utility control are not covered (i.e., out of scope) .
    - The ‘exemption’ precludes electrical inspection of central office, telephone closets, and similar facilities.
  - **Section 90.3** - Chapter 8, *Communications Systems*, is not subject to the requirements of Chapters 1–7.
    - The ‘independence’ of Chapter 8 precludes application of electrical power requirements to communications facilities.
- Several modifications and clarifications to 90.2 and 90.3
- Both these provisions will remain unaffected and intact in the 2017 NEC.

## CMP 1 Activities - cont....

### ■ Test and Inspections

First Revision FR-36 to a new Section 110.41 to read as follows

#### **110.41 Inspections and Tests**

(A) Pre-energization and Operating Tests. Where required elsewhere in this Code, the complete electrical system design, including settings for protective, switching, and control circuits, shall be prepared in advance and made available on request to the authority having jurisdiction and shall be tested when first installed on-site.

(B) Test Report. A test report covering the results of the tests required in 110.41(A) shall be available to the authority having jurisdiction prior to energization and made available to those authorized to install, operate, test, and maintain the system.

Such a detailed description of inspection and test procedures and format are not very practical and may be unsuitable for many circumstances.

However, the proposed text is restrictive in that it strictly applies to electric power service and not designed for communications installations. Therefore it does not affect communications facilities significantly yet.

# CMP 1 Activities - cont....

## ■ Lower Voltage Limits expanded from 600 to 1000 Volts (Accepted)

- 900-1000 Volts Solar Farms
- UL Listings
- Concerns include
  - Working space around equipment
  - Safe exit and egress (lighting, clear pathway and space)
- Increased to 2000 volts in some parts of code (CMP5)
  - Coordination issue across code remains



## ■ Arc Flash – Risk assessment and Warning Labels (Accepted)

- NFPA 70 (NEC) and 70E
- NESC Rule 410A .....IEEE 516.....OSHA
- Spaces around equipment
- Risk assessment for Telecom workers in their normal activities on telecom circuits = zero to minimal risk from
  - Exceptions : Work in substations, on/in power systems, and with backup battery installations



## CMP 1 Activities - cont....

### ■ **Listed versus Labelled** (mostly rejected)

- Listed vs labeled vs marked vs approved vs approved for purpose....
- Certification marks
- Product specifications and testing (GRs)
- NEC has significant input from and tie ins to equipment manufacturers and NRTL testing and certification companies

### ■ **Qualified** (several PIs were rejected)

- Public and unqualified persons
- Licensed electrician versus training
- Qualified = trained
- NEC has significant input from inspectors and unions

Qualified = “ one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved”

## → CMP 5 - Intersystem Bonding Termination or IBT (Article 250.94)

- CMP 5 rejected PIs that would have
  - Expanded items mandated or allowed to bond to IBT
    - gas piping (CSST), separately derived systems
  - Permit additional intersystem bonding terminations be placed in several locations around premises
- Process was managed to revise 250.94 to the benefit of communications providers through
  - **250.94 Bonding for ~~Other~~ Communication Systems** = change title to highlight and strengthen the rationale that the IBT is intended to provide a reliable common bonding point primarily for communications circuits to the power service grounding conductor and the grounding electrode system.
  - Add a new 250.94(B) that provides an option to use a copper busbar as a bonding connection point if an IBT is not readily available. As communications facilities are extended and expanded to include many other buildings and structures, the ability to use such a busbar as a surrogate IBT will be useful for both communications companies and customers.





# New Proposed Article 250.94 (FR-1215)

**250.94 Bonding for ~~Other~~ Communication Systems.** Communications system bonding terminations shall be connected in accordance with (A) or (B).

(A) Intersystem Bonding Device. An intersystem bonding termination (IBT) for connecting intersystem bonding conductors ~~required for other systems~~ shall be provided external to enclosures at the service equipment or metering equipment enclosure and at the disconnecting means for any additional buildings or structures. ~~The~~ If an intersystem bonding termination device is used it shall comply with the following:

- (1) Be accessible for connection and inspection.
- (2) Consist of a set of terminals with the capacity for connection of not less than three intersystem bonding conductors.
- (3) Not interfere with opening the enclosure for a service, building or structure disconnecting means, or metering equipment.
- (4) At the service equipment, be securely mounted and electrically connected to an enclosure for the service equipment, to the meter enclosure, or to an exposed nonflexible metallic service raceway, or be mounted at one of these enclosures and be connected to the enclosure or to the grounding electrode conductor with a minimum 6 AWG copper conductor
- (5) At the disconnecting means for a building or structure, be securely mounted and electrically connected to the metallic enclosure for the building or structure disconnecting means, or be mounted at the disconnecting means and be connected to the metallic enclosure or to the grounding electrode conductor with a minimum 6 AWG copper conductor.
- (6) The terminals shall be listed as grounding and bonding equipment.

## New Proposed Article 250.94 (FR-1215)... continued

Exception: In existing buildings or structures where any of the intersystem bonding and grounding electrode conductors required by 770.100(B)(2), 800.100(B)(2), 810.21(F)(2), 820.100(B)(2), and 830.100(B)(2) exist, installation of the intersystem bonding termination is not required. An accessible means external to enclosures for connecting intersystem bonding and grounding electrode conductors shall be permitted at the service equipment and at the disconnecting means for any additional buildings or structures by at least one of the following means:

- (1) Exposed nonflexible metallic raceways
- (2) An exposed grounding electrode conductor
- (3) Approved means for the external connection of a copper or other corrosion-resistant bonding or grounding electrode conductor to the grounded raceway or equipment

(B) Other Means. Connections to an aluminum or copper busbar not less than 6 mm thick x 50 mm wide (1/4 in. thick x 2 in. wide) and of sufficient length to accommodate at least three terminations for communication systems in addition to other connections. The busbar shall be securely fastened and shall be installed in an accessible location. Connections shall be made by a listed connector. If aluminum busbars are used, the installation shall comply with 250.64(A)

Exception to (A) and (B) Methods for bonding intersystem bonding conductors are not required where communications systems are not likely to be used.

Informational note: The use of an IBT can reduce electrical noise on communication systems.

When accepted → will need some minor harmonization effort  
within parts of in Chapter 8 during comment period

## CMP 5 Activities - cont....

- Equipment Grounding Conductor Vs. Equipment Bonding Conductor
  - Recognized that the EGC also performs bonding
- Actual versus Nominal Volts (PIs for ‘actual’ were Rejected)
  - “Nominal” is particularly apt, more flexible and useful for telecom applications.
- Physical Protection of Grounding Electrode (Accepted)
  - Being visible does not make a conductor vulnerable to physical damage
  - Ground electrode conductors laid along the surface of the ground are vulnerable and should be protected from physical damage by coverings or through simple burial.
- Copper Clad Stainless Steel (CCSS) Conductors – Rejected
  - Inspections concerns re: determining equivalent % conductivity
  - Rigid CCSS versus flexibility required in house installations
- Multi-Ground Neutral System – PI to prohibit or limit was Rejected
  - CMP5 reaffirmed multi-grounded systems provide additional safety for electrical workers, lightning protection and have a proven track record for safe operation

# → CMP 16 Activity - Mechanical Execution of Work

## Necessary Protection (?)

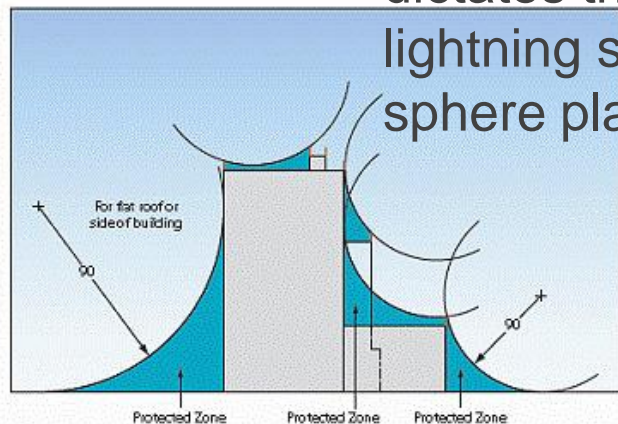
(770.24...800.24...820.24...830.44...840.24)

- Pls expands reference to all of 300.4
  - 300.4(D) is sufficient and adequate
- Achieved rejection of these unwarranted additional mechanical protection requirements for Communications cables (twisted pair and coax) run in buildings - 800.44 and 820.44
- Rejection of these unwarranted additional mechanical protection requirements is still a work in progress
  - Fiber cables – 770.24 – 2014 Errata... 2017 First Revision
  - The requirements of 300.4 are appropriate for power wiring, not optical fiber cables. Neither a fire nor electrical safety hazard has been identified to justify expanding the requirements of 700.24.
  - Cables associated with Network Powered (830) systems .. 2017 First Revision currently includes “....The installation shall also conform to 300.4(A), (D), (E), (F) and 300. 11...”
- **Formal Ballot not complete yet – the above can change**



## CMP 16 Activities - cont....

- **Intersystem Bonding Termination** and 250.94 - Harmonization and clarifications to grounding and bonding terminology throughout Article 770 and Chapter 8
- Retention of the **5-foot communications ground rod** in Articles 770, 800 and 830
- Introduction of the “**rolling sphere**” theory of lightning exposure.
  - Article 810, Radio and Television Equipment
  - Grounding requirements of antenna masts and metal supporting structures can benefit from protection afforded by surrounding taller structures.
  - CMP 16 introduces the “rolling sphere” theory of lightning exposure as described in **NFPA 780**. The “rolling sphere” theory dictates that a tall structure provides a “zone of protection” from lightning strikes within an area described by a 300-foot diameter sphere placed adjacent to that structure.



# CMP 16 Activities - Definitions

Addition of an Informational Note to the definition of **Communications Equipment** clarifies servers and routers are part of communications equipment & facilities.

- **NEC accepted Jan 2015 meeting - Communications Equipment**

The electronic equipment that performs the telecommunications operations for the transmission of audio, video, and data, and includes power equipment (e.g., dc converters, inverters, and batteries), technical support equipment (e.g., computers), and conductors dedicated solely to the operation of the equipment.

*Informational Note: This definition clearly indicates that the dc power as well as computers are considered to be part of the communications equipment. As the telecommunications network transitions to a more data centric network, communications equipment will also include routers and servers essential to the transmission of audio, video, and data.*

- **NESC – Open item still - Communications Equipment.**

Communication Equipment. Equipment that produces, modifies, regulates, or controls communication signals. This equipment may also produce, modify or safeguard a supply of electric energy for the exclusive use of communication devices. If the potential difference does not exceed 400 V to ground or 750 V between any two points on the equipment or on the circuit connected to the equipment, then the transmitted power cannot exceed 150 W. Where the potentials do not exceed 90 V ac or 150 V dc, no limit is placed on the transmitted power.



## CMP 16 Activity on Article 840

- Expansion of Article 840 to cover Power over Ethernet (PoE) and to include twisted-pair and coaxial cable as well as optical fiber cable,

**Scope:** This article covers premises-powered broadband communications systems.

Informational Note No. 1: A typical basic system configuration consists of an **optical fiber, twisted pair or coaxial cable** to the premises supplying a broadband signal to a network terminal that converts the broadband signal into component electrical signals, such as traditional telephone, video, high-speed internet, and interactive services.

Powering for the **network terminal** and network devices is typically accomplished through a premises power supply that might be built into the network terminal or provided as a separate unit. In order to provide communications in the event of a power interruption, a battery backup unit or an uninterruptible power supply (UPS) is typically part of the powering system.

- Concerns associated with safely powering premises equipment (PoE) over cables traditionally viewed as carrying only low-voltage, low-current signals were addressed by revisions.

## CMP 16 Activity on Article 840.... cont....

### ■ Article 840 - references

- Article 770 for optical fiber cables
- Article 800 for communications circuits
- Article 820 for community antenna and radio distribution circuits,
- Article 725 for Class 2 and Class 3 circuits
- Article 760 for power-limited fire alarm circuits.
- Numerous revisions are made throughout the Article to accommodate the introduction of twisted-pair and coaxial cables.
- New Sections to provide listing requirements for equipment, the power source, and cables, and grounding devices.
- System voltages are limited to a maximum of 60 V dc and are considered power- limited sources. Efforts to raise the voltage level were thwarted by CMP 16 members concerned that voltages above 60 V dc are considered an electrical shock hazard.

# CMP 16 Activity on Article 840.... cont....

## VI. Premises Powering of Communications Equipment over Communications Cables

Informational Note: This Part addresses types of circuits intended to provide power over coaxial cables and communications wires and cables to remote equipment, including systems such as **Power over Ethernet (PoE)**. These premises-powering systems do not include circuits such as those that provide plain old telephone services (POTS), traditional CATV services and similar legacy communications services.

**840.160 Powering Circuits.** Communications cables, in addition to carrying the communications circuit, shall also be permitted to carry circuits for powering communications equipment. The communications cables and the powering circuits shall comply with 840.160(A), (B) and (C), as applicable.

(A) **Power Limitations.** The power circuits shall comply with the requirements of Table.11(B) in Chapter 9 for **voltage sources up to 60 V dc.**

Informational Note: The **100 VA (100 W) power source maximum** nameplate rating in Chapter 9, Table 11(B) is the same as the maximum power rating for network-powered broadband communications systems in Table 830.15, the communications industry standard in ATIS-0600337 and UL 60950-21.

## CMP 16 Activity on Article 840....cont....

(B) **Ampacity.** The maximum current carried by each communications conductor shall conform to Table 840.160(A).

Informational Note: The ampacity of the small wire gauges used in communications cables are not included in the ampacity tables in Article 310.

(C) **Installations of New Cables.** New cables installed for carrying both communications and power, where the maximum adjusted ampacity of conductors exceed the values in Table 840.160(A), shall be Type CMP-LP, CMR-LP or CM-LP, as applicable.

( D) **Using Cables Without the “ LP” Marking for Supplying Premises Power and Communications.** New and existing cables without the “LP” marking shall be permitted to connect to communications equipment that supplies communications and power in accordance with the voltage and power limitations of Table 11(B) in Chapter 9 for voltage sources up to 60 V dc, provided that the maximum current supplied by the power source is less than the adjusted ampacity of conductors in Table 840.160(A). For ambient temperatures other than 30°C (86°F) ampacity shall be permitted to be adjusted per Table 310.15(B)(2)(a).

# CMP 16 Activity on Article 840..... cont....

**Table 840.160(A), Communications Conductor Ampacity Based on Copper Conductors at Ambient Temperature of 30°C (86°F), Conductor Temperature 60° C (140° F)**

<b><u>Conductor Size (AWG)</u></b>	<b><u>Ampacity Of Each Conductor In A Single 4-Pair Multipair Communications Cable Installed Separated From All Other Cables</u></b>	<b><u>Ampacity Of Each Conductor In A Multipair Communications Cable When More Than One Cable Is Installed Together Or The Multipair Cable Is Larger Than 4 Pairs</u></b>
<u>26</u>	<u>0.8</u>	<u>0.4</u>
<u>24</u>	<u>1.3</u>	<u>0.6</u>
<u>23</u>	<u>2.0</u>	<u>1.0</u>
<u>22</u>	<u>3.1</u>	<u>1.5</u>

Informational Note: The conductor size of existing communications cable, including “category X” type cables, can be as small as 26 AWG.

# Tables 11 B – Chapter 9 (NEC)

Table 11(B) Class 2 and Class 3 Direct-Current Power Source Limitations

Power Source	Inherently Limited Power Source (Overcurrent Protection Not Required)				Not Inherently Limited Power Source (Overcurrent Protection Required)					
	Class 2				Class 3	Class 2		Class 3		
Source voltage $V_{max}$ (volts) (see Note 1)	0 through 20 <sup>a</sup>	Over 20 and through 30 <sup>b</sup>	Over 30 and through 60 <sup>b</sup>	Over 60 and through 150	Over 60 and through 100	0 through 20 <sup>a</sup>	Over 20 and through 60 <sup>b</sup>	Over 60 and through 100	Over 100 and through 150	
Power limitations $VA_{max}$ (volt-amperes) (see Note 1)	—	—	—	—	—	—	—	—	N.A.	
Current limitations $I_{max}$ (amperes) (see Note 1)	8.0	8.0	$150/V_{max}$	0.005	—	5.0	$100/V_{max}$	$100/V_{max}$	1.0	
Maximum overcurrent protection (amperes)	—	—	—	—	—	5.0	$100/V_{max}$	$100/V_{max}$	1.0	
Power source maximum nameplate rating	VA (volt-amperes)	$5.0 \times V_{max}$	100	100	$0.005 \times V_{max}$	100	$5.0 \times V_{max}$	100	100	100
	Current (amperes)	5.0	$100/V_{max}$	$100/V_{max}$	0.005	$100/V_{max}$	5.0	$100/V_{max}$	$100/V_{max}$	$100/V_{max}$

**Power Source Maximum Power = 100 Volt-Amp**  
**Current =  $100/V_{max}$**

# CMP 12 Activities on

## Article 645 – Information Technology Equipment

Concerns with current 645.10 – Emergency Power Off -

- Single emergency disconnect potentially provides a single point of mechanical failure that increases the risk of false shutdown and can, through human error or criminal intent (sabotage, terroristic threat), shut down the entire data center resulting in disruption of normal business activity.
- First Proposal (PI) - Delete entire Article 645.10. - **Rejected**
- Second Proposal (PI) – **Partially Accepted**
  - Change from qualified personnel to knowledgeable personnel – **Rejected** → sends one to the NEC definition of “qualified” =  
*“ one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved”*
  - Now does not require person to be on-site → **ACCEPTED**  
→ No longer required to staff sites 24 hours per day and allow a more flexible work schedule for emergency service personnel

## CMP 12 Revisions to Article 645.10

(B) **Critical Operations Data Systems.** Remote disconnecting controls shall not be required for critical operations data systems when all of the following conditions are met:

(1) An approved procedure has been established and maintained for removing power and air movement within the room or zone.

(2) Qualified personnel are continuously available to ~~meet~~ **advise** emergency responders and to ~~advise~~ **instruct** them of disconnecting methods.

(3) A smoke-sensing fire detection system is in place.

Informational Note: For further information, see **NFPA 72**, National Fire Alarm and Signaling Code.





# Reorganization of Chapter 8



During 2014 - CMP 16 Chair –

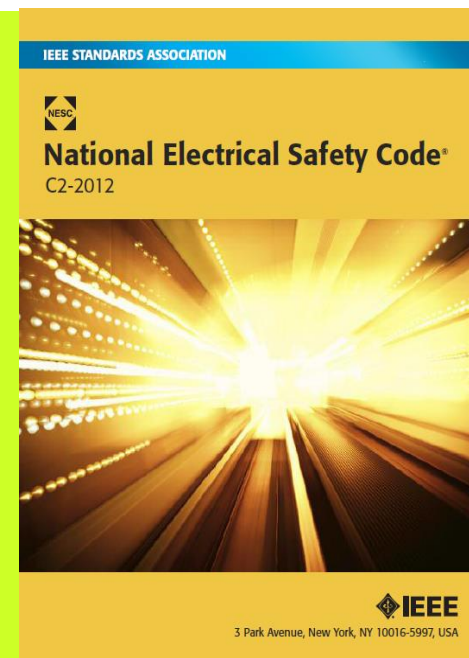
Initiative to combine all Chapter 8 articles into new Article 800, Communications

- Rationale
  - Reduce number of proposals and comments
  - Reduce duplication and improve usability
  - Eliminates flipping between parts to obtain information
  - Promotes Code usability
- 2014 - Task Group to weigh merits of reorganization
  - ATIS representatives appointed to task group
- Task Group Conclusion was to retain present arrangement

**Probably not over yet**

# Highlights from the NESC Revision Process

<http://standards.ieee.org/about/nesc>



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# Drivers for NESC Changes

## PRIMARY = REACTIVE

- Problems, issues and conflicts revealed during active use of NESC
  - Problems during Engineering/Design/Planning activities
  - Joint-Use Agreement Conflicts – Wireless, Light Rail....
  - Regulatory Inspections - OSHA and AHJ Compliance
  - Regulatory Harmonization and Feedback
    - FCC, Public utilities – Boards and Commissions
  - Field incidents, accidents, and legal cases

## SECONDARY = PROACTIVE (5 year code cycle can limit reaction time)

- Mismatch of new technologies to practices based on traditional code
  - Intersystem Grounding & Bonding
  - Wireless Antennas – Growth into Femtocells and DAS systems
  - Smart Grid Devices – joint power and communications functions
  - Alternate and hybrid sources of energy – wind, solar, etc....

# CONGESTION





# Underlying Concerns & Issues

- **Bonding and Grounding (Rule 096, 097, 099)**
- **Congestion on Poles and in Buried locations (Sections 2 and 3)**
- **Scope Boundaries of NESC/NEC - Codes Inter-Relationship**
  - **NESC...NEC...GO95**
- **Risk Management - Work Rules**
  - **Worker & Public Safety (Part 4 - Work Rules)**
- **Clearance and Separation (SC4 and Sections 20-23)**
- **Pole Loading and Strength (SC5 and Sections 24-26)**
  - How Conservative should one be?
  - Guidance from Historical Data and Experience Vs. Latest LRFD Engineering Approach ?

Competing Views from Engineers (Design/Plan) -- Statisticians -- Meteorologists -- Regulators -- AHJs



# SC1 – Actions on Scope & Purpose

## SC1 - Purpose & Scope

- Clarifications
- Single global section on *Testing & Inspections* (Rejected for moment)
- Persons vs Life – protection thereof

## SC1 and other SCs - Definitions

- Communications and Supply Space (Rejected for moment)
- CWSZ = Communications Worker Safety Zone
  - Defined by rules not by definition
- Communications Equipment (Accepted)
- Supply Equipment (Accepted)
- Qualified vs Trained vs Authorized (Harmonized across code)
- Structure Conflicts (remains under active debate)
- Messenger

# SC1/SC4 – Actions on Definitions

New Proposed NESC Definitions– still open items

- **Electric Supply Equipment**


Proposal A - Equipment that produces, modifies, regulates, controls, or safeguards a supply of electric energy for the electric power supply grid.

Proposal B - Equipment that produces, modifies, regulates, controls, or safeguards a supply of electric energy that is transferred to supply lines or used to provide power and/or control for other electric supply equipment or used to provide power to the devices of another utility.

Proposal C to add Note - NOTE: Electric supply equipment does not include equipment whose primary purpose is to provide power to support locally mounted communication systems. For example, power supplies supporting CATV or communication amplifiers or repeaters are not considered to be supply equipment.

- **Communications Equipment.**

**Communication Equipment.** Equipment that produces, modifies, regulates, or controls communication signals. This equipment may also produce, modify or safeguard a supply of electric energy for the exclusive use of communication devices. If the potential difference does not exceed 400 V to ground or 750 V between any two points on the equipment or on the circuit connected to the equipment, then the transmitted power cannot exceed 150 W. Where the potentials do not exceed 90 V ac or 150 V dc, no limit is placed on the transmitted power.



# SC2 – Actions on Grounding

## SC3 - Substations

### SC2 - Grounding

- Grounding Intervals (096C)
  - Exception added for long spans (water and valley crossings)
  - Do not need to open sheath solely to meet 4 ground per mile
- Effectively Grounded versus grounded
  - Grounded through hardware and guys
- Copper Clad Stainless Steel Conductors (% conductivity)
- Rule 097 – Bonding between power and communications grounds
- Rule 099 – Intersystem Bonding at House

### SC3 – Power Sub-Stations

- Fences and Access Control
- Storage Batteries (Section 14... Rule 420G)



## → Rule 097 - Separation of Grounding Conductors

Rule 097 has seven (7) individual interlocking sections with connections to other rules (e.g., 096, 224, 344, 354 and 384) applicable to intersystem bonds

- Rule 097A requires separate grounding conductors except as permitted by 097B providing 097C (4 grounds/mile) is met.
- Rule 097B – permits a bond to the power ground where a MGN system is being used and providing Rule 097C (i.e., 4 grounds/mile) is met.
  - The combination of Rule 097B with 097C is the basis for the practice of bonding communications to the vertical pole supply ground in MGN systems with a 6AWG conductor and approved connector. It is highly desirable to maintain and encourage this practice with an intersystem bond between power and communications systems as the first choice if practical.
- Rule 097C - 4 grounds/mile criteria for an effective ground
- Rule 097G requires a single grounding conductor on structures except as required by Rule 097A
  - One objective of Rule 097G is to distinguish between intersystem bonding necessary in cases of MGN power systems as opposed to ungrounded or single grounded systems.

# → Rule 097G Proposal History

## Current 097G

### G. Bonding of communication systems to electric supply systems

Where both electric supply systems and communication systems are grounded on a joint use structure, either a single grounding conductor shall be used for both systems or the electric supply and communication grounding conductors shall be bonded together, except where separation is required by Rule 97A. Where the electric supply utility is maintaining isolation between primary and secondary neutrals, the communication system ground shall be connected only to the primary grounding conductor.

### **Change accepted in 2013/2104 as follows –**

### **G. Bonding of communication systems to electric supply systems**

Where both electric supply systems and communication systems are to be grounded on a the same joint use structure, either a single grounding conductor shall be used for both systems or the electric supply and communication grounding conductors shall be bonded together, except where separation is required by Rule 097A. Where the electric supply utility is maintaining isolation between primary and secondary neutrals, the communication system ground shall be connected only to the primary grounding conductor if it complies with the requirements of Rule 097C.

### **Telcordia supported this actions as the best interim measure with the following affirmative comment in ballot :**

*“These accepted changes to Rule 097G help clarify the rule. However, the last sentence of revised Rule 097G requires work to better clarify when, and when not, a bond is appropriate between communications grounds and supply grounds in single-point grounded systems and cases where isolation is being used in power system. Further work on a revision to the last sentence of Rule 097G should be considered.”*

## Rule 097G Comment Proposal

- **Rule 097 – Bonding between power and communications grounds**

Telcordia prefers and recommends accepting CP4425 and making further changes that will revise Rule 097G to read as follows:

### G. Bonding of communication systems to electric supply systems

Where both electric supply systems and communication systems are grounded on a joint use structure, either a single grounding conductor shall be used for both systems or the electric supply and communication grounding conductors shall be bonded together, except where separation is required by Rule 97 A. **Where the electric supply utility is maintaining isolation between primary and secondary neutrals, the communications system ground shall be connected as follows:**

#### **1. Ungrounded or single-grounded systems**

**The communication system ground shall be connected only to the secondary neutral's grounding conductor**

#### **2. Multi-grounded systems**

**The communication system ground shall be connected only to the primary grounding conductor.**

# Intersystem Bonding Summary

- **Rule 097 – Bonding between power and communications grounds**
  - More separate telecom grounds
    - Single ground rods
    - Ground beds – 3 rods
    - Bond grounding systems together
  
- **Rule 099 – Intersystem Bonding at House**
  - NEC would be best to follow
  - Intersystem bond near meet box or point of entrance following Chapter 8 (e.g., 800-Part III Protection or 250.94 on the IBT)
  - 6 AWG copper preferred
  - Single ground rod
    - If doubt about ground resistance → add auxiliary rod for maximum of 2 rods bonded together.,



# SC4 Actions – Aerial Order, Clearances, Grounding

- **Rule 220**
- **Preferred Level (Order ) on Pole – Supply preferred on top with Communications below (Rule 220)**
  - Allowance for service drops, railroads, light rail and trolley wires
  - Changes confuse rather than clarify → comment planned to return to 2012 text



- **Rule 215 - Guys and guy insulators**
  - Effectively grounded
  - Connections through hardware
  - Objective is that if guys are slack or broken, the guys do not create hazard to public
  - Reference “safe” height is 8 feet  
(CP to increase to 14 feet was rejected)
- **Guy Markers (Rule 217)**
- **Vegetation Management (Rule 218)**





# Clearance and Separation

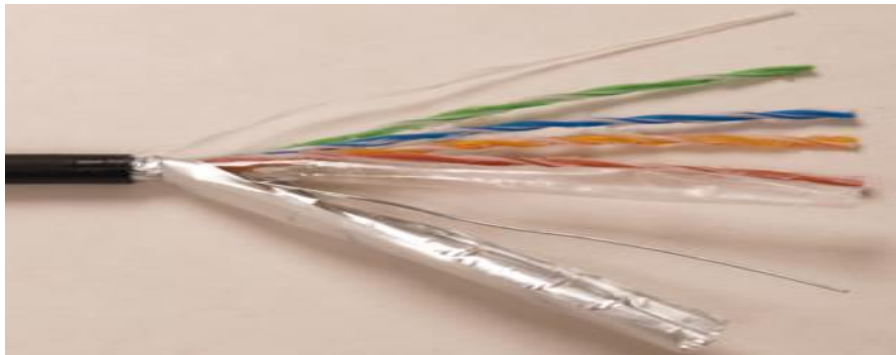
## SC4 Actions – Aerial Clearances.. cont...

### ■ Rule 224B - Powering circuits used exclusively for communications circuits

- Cable shielding vs individual conductor shielding
- Outer Shield on cable is sufficient

Modern communications cables can and may include supply circuits for Power-over-Ethernet (PoE) and applications and other communications devices (e.g., antenna). Requiring each conductor of a supply circuit used exclusively to power communications devices to be “*individually enclosed with an effective shield*” is not necessary. Having additional shields around each individual conductor does not add significantly to the safety of the circuit or cable configuration.

- Equivalent change was accepted for Rule 344 (underground rule)
- Supportive comment to change 224B planned





# SC4 Actions Aerial Clearances...



## ■ **Emergency Installation**

- Grade of construction (SC5) – Grade N
- Permits laying cables on grade providing they are guarded.
- Emergency versus temporary... how long is temporary?

## ■ **Metric versus Customary Units** (meters vs feet)

## ■ **SC4 Clearance Sections 20-23 vs SC5 Strength Sections 24-26**

- Clearance & Spacing → sags plus conductor loadings
- Pole strength → tensions and safety factors

## ■ **Road/Field clearance for large farm vehicles**

- Increase reference ground clearances to accommodate larger and larger farm vehicles (cotton strippers and grain tanks). → rejected
- The NESC cannot prevent manufacturers from building machines of any heights. The NESC already includes methods of adjusting clearances where it is desired to build lines to allow over-height equipment. See Footnote 25 to Table 232-1, Footnote 3 to Table 232-2, and Footnote 16 to Table 234-1.
- Conflicts with Irrigation Systems



# SC4 Actions – Aerial Clearances.. cont...

## ■ **Water Crossings and Bridges**

- Defined by area, and the possible boat/yacht traffic...

## ■ **Driveways**

- Residential versus Business
- Rural vs urban
- Changing behavior under line
- Ground clearances are always minimums → design with objective to attain as much clearance and spacing as practical and possible.
- Minimum values

## ■ **Service masts and Service Drops**

- Distances from openings (e.g., windows, doors) accessible areas (over roofs, porches, swimming pools.....)



## SC4 Actions – Aerial Clearances.. cont...

- **Space Definitions**
  - Communications space
  - Supply space
  - “commonly understood” terms that can descend into complexity as legal code
- **Clearances between communications lines** – CP 47126 for Rule 235H was accepted to clarify that communications cables need to have minimum of
  - 12 inch separation at support
  - 4 inch anywhere in span
  - under all ambient conditions (under all expected conditions)
  - Other CPs 4667 & 4335 to include complicated scenarios with multiple ice and wind loading calculations under different temperatures and conditions were rejected. Communications conductors are not subject to temperature increases during use line power lines.
  - Wording of final rule may need revision during comment period

## SC4 Actions – Aerial Clearances.. cont...

### ■ Facility Conflicts – New Rule 237 G

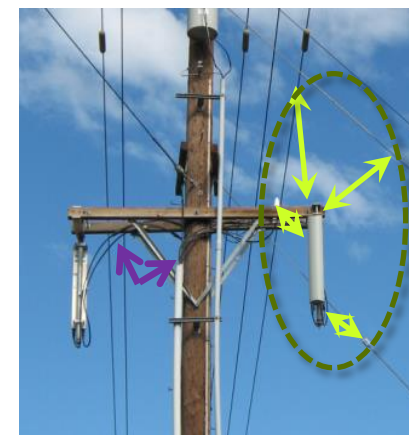
G. Location of equipment in the working space required for other equipment, conductors, or cables.

Supply and communication equipment shall not be located in the working space required for another piece of equipment, a conductor, or a cable.

- This may be a good idea but it is not clear how this rule is to be used with problems about words such as “...required for...” . How does one manage for future or planned equipment placement – first come ?

### ■ Wireless (Antenna) Attachment– Rule 235I clarified

- All other clearances need to be met as facilities are attached to congested poles with multiple communications and power facilities
- Challenge to work out engineering designs to meet the conditions and still allow for the necessary and adjustments and customizations that will be needed during installation



### ■ Rule 238 – Clearance between communications and supply facilities

- CP (ATIS) accepted - Encourages grounding of supply equipment by having larger (40 inch) separation for ungrounded supply equipment

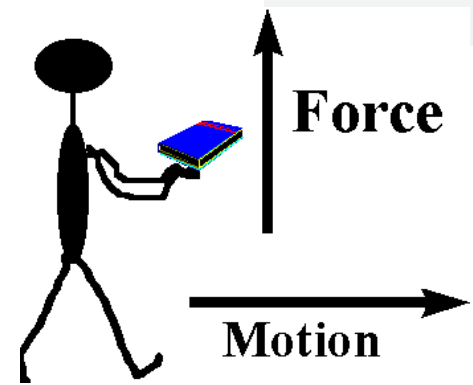
# SC5 Actions - Pole Strength & Loading

Several meeting/ballot votes were 50-65%

→ not consensus but enough to change code

→ Issue remains open for comment period

- **60 foot exemption** – TB Prediction → likely to be retained
- **Construction Grade N** used for temporary work, private rights of way and service drops
  - TB Prediction → Grade N is likely to be retained but with clarifications and changes to more clearly define where, when and how it shall be used.
  - Grade B = highest grades – for joint use and railroad crossings applications
  - Grade C = traditionally most of communications only poles built to this grade
- **“K additive constant”** -
  - TB Prediction → likely to be retained
  - Elimination of constant would require concomitant multiple changes to wind loads. Without clear safety gains from such work, there is little support to pursue the effort.
- Given the long successful field record and performance of pole lines, there is no need to, or SC5 intent to require an increase in the required pole strength for a given application and environment



## SC7 Actions – Underground/Buried

- Water crossings – grounding interval (096C)
- Railroad crossings – outside of trackbed (includes shoulders)
- Conduit vs duct
- Backfill – “....Backfill material should be adequately compacted to limit settling under the expected surface usage...”
  - specific guidance in the Recommendation of this rule was removed from the rule since the recommendation attempts to describe specific dimensions and types of items that could damage a conduit.
  - SC7 decided this specific type language should not be in the Code and should be left up to the utility to make this determination.
  - Internal practice documents and M&Ps (e.g., old BSPs , BRs, Telcordia Construction Blue Book) . .
- **Rule 344** - Communications cables containing special supply circuits
  - ATIS CP was accepted

## SC7 Actions on Rule 344

- Rule 344 - Communications cables containing special supply circuits
  1. Such cables shall have a conductive sheath or shield that shall be effectively grounded and each such circuit shall be carried on conductors that are individually enclosed with an effectively grounded shield.
    - Rationale accepted that - For cases where more than one such circuit is present in a multiple pair cable, it is not necessary for safety to “individually” enclose each such circuit in its own shield. The effectively grounded shield of the overall cable provides sufficient and adequate protection when combined with other requirements of 344A2 through 344A6.
- Covers communications cables that include supply circuits for span-powering and Power-over-Ethernet (PoE) applications
- Equivalent change for Rule 224B was put on hold and further information requested (equivalent aerial plant rule)



# SC7 Actions on Rule 354 – Random Separation

## Rule 354 – Joint Buried – Random Separation ... .. 096C

- CP 4262 – Where long un-interrupted spans of cables exist, the requirement to ground 4 or 8 times per mile should be relaxed. The basic principle being that one should not open a cable sheath for the sole purpose of grounding a shield or conductor.
- “However, at all locations where the cable is accessible to personnel, the neutral shall be effectively grounded” which helps to clearly state the importance of grounding plant as soon as practical outside of the long uninterrupted span.– e.g., in a hut, padmount cabinet, pedestal, etc... provides -
  - (i) adequate safety to drain away any foreign voltage/current from communications circuits
  - (ii) help ensure under power fault conditions that the supply circuit is de-energized and protection devices operate efficiently as power Rule 354A3.

## SC7 Actions on Rule 354 .....cont..

### Rule 354 – Joint Buried – Random Separation

CP 4722 – modernize Rule 354D3 to accommodate standard cable designs but retain adequate safety margin

- Rule 354A3 and Rule 354D1f are the requirements to provide adequate protector devices and a grounding system to promptly de-energize a supply circuit if necessary.
- The Rule 354D1e requires a metallic shield on the communications cable that should help minimize or reduce any foreign voltages and currents on the twisted pairs.
- **Deletion of the 354D3a requirement that the conductance of the grounded conductor shall be “not less than one half that of the phase conductor” is not a concern for communications plant sharing the joint trench.**
  - It is an issue of power cable design and for power utility operations and their safety. The safety of the adjacent communication plant and their workers is well covered by the remaining parts of the Rule 354D3b and 354D3c. The inclusion of the exception harmonizes with the changes to Rule 096 (see Section 2.2 of this report for details of those Rule 096 changes).



## SC7 Actions on Rule 354...cont..



### 3. Insulating jacketed grounded neutral supply cables

Each phase conductor of a multi-grounded supply system operating above 300 V to ground and having an overall insulating jacket shall have an effectively grounded copper concentric conductor meeting all of the following requirements:

- ~~a. A conductance not less than one half that of the phase conductor.~~
- ~~b.~~-a. Adequate for the expected magnitude and duration of fault current that may be imposed.
- ~~c.~~-b. Grounded in accordance with Rule 314 except that the grounding interval required by Rule 96C shall be not less than eight in each 1.6 km (1 mile) of the random buried section, not including grounds at individual services.

Exception: The grounding interval of Rule 354D3b may be increased for grounded neutral supply cables with insulating jackets where adherence would require opening a non-metallic duct or removing the protective jacket of the buried cable only for the purpose to install a ground connection. For such cases, the supply circuit shall be effectively grounded where the cable does become accessible. Where practical, the ground of the supply circuit shall be bonded together with the communications shield ground.

•



# SC8 Actions on Work Rules (Part 4)

## SC8 – Work Rules (Part 4 : Sections 40-to-44)

- 2013 – formal ballots on CPs
- 2014 - OSHA released new electrical worker rules 29 CFR 1910.269, “Electric Power Generation, Transmission, and Distribution”
- 2014 SC8 working group generated new CPs
  - **Arc Flash PPE & Risk Assessment**
    - NESC 410 A3.... OSHA.... IEEE 516 ... NFPA 70E
    - DC voltage limit – 50 V to 250 V and up to 8000 amps → use 5 cal/cm<sup>2</sup> PPE
  - **Fall Protection** .... NESC 411F & 420K1.... OSHA 1910.268/269
    - Fall Prevention versus Fall Arrest
    - Now activates at working heights above 4 feet (was 10 feet)
    - Climbing to versus at Working position - work from ladder (420J)
  - **Minimum Approach Distances (MAD)** - Rules 431 & 441
    - NESC 410 A3.... OSHA.... IEEE 516
    - Reach and Extended reach – with/without tools

# SC8 Actions on Table 431-1

## SC8 – Work Rules – Rule 431 Minimum Approach Distances (MAD)

- Communications Employees

**Table 431-1—Communication work minimum approach distances<sup>3,4</sup>**  
(See Rule 431 in its entirety.)

Voltage range Phase-to-Phase (rms)	Distance to employee at altitudes from sea level to 12 000 ft		
0 to 50 V <sup>2</sup>	Not specified		
51 to 300 V <sup>2</sup>	Avoid contact		
301 to 750 V <sup>2</sup>	1 ft-1 in		
751 V to 15 kV	<u>2 ft-3 in</u> <del>2 ft-2 in</del>		
15.1 kV to 36 kV	3 ft-0 in		
36.1 kV to 46 kV	3 ft-6 in		
46.1 kV to 72.5 kV	4 ft-0 in		
	At altitudes from		
	Sea level to 3000 ft	3001 to 6000 ft	6001 to 12 000 ft
72.6 kV to 121.0 kV	4 ft-9in	<u>5 ft-0 in</u> <del>4 ft-11 in</del>	<u>5 ft-10 in</u> <del>5 ft-5 in</del>
121.1 kV to 145.0 kV	<u>5 ft-4 in</u> <del>5 ft-3 in</del>	<u>5 ft-8 in</u> <del>5 ft-7 in</del>	<u>6 ft-8 in</u> <del>6 ft-1 in</del>
145.1 kV to 169 kV	5 ft-10 in	<u>6 ft-3 in</u> <del>6 ft-2 in</del>	<u>7 ft-3 in</u> <del>6 ft-10 in</del>
169.1 kV to 242 kV	<u>7 ft-8 in</u> <del>7 ft-6 in</del>	<u>8 ft-2 in</u> <del>8 ft-0 in</del>	<u>9 ft-8 in</u> <del>8 ft-11 in</del>
242.1 kV to 362 kV	<u>12 ft-3 in</u> <del>12 ft-2 in</del>	<u>13 ft-2 in</u> <del>13 ft-0 in</del>	<u>15 ft-8 in</u> <del>14 ft-9 in</del>
362.1 kV to 420 kV	14 ft-11 in	<u>16 ft-2 in</u> <del>16 ft-0 in</del>	<u>19 ft-2 in</u> <del>18 ft-2 in</del>
420.1 kV to 550 kV	17 ft-8 in	<u>19 ft-0 in</u> <del>18 ft-11 in</del>	<u>22 ft-8 in</u> <del>21 ft-7 in</del>
550.1 kV to 800 kV	<u>23 ft-8 in</u> <del>23 ft-7 in</del>	<u>25 ft-5 in</u> <del>25 ft-4 in</del>	<u>30 ft-4 in</u> <del>29 ft-0 in</del>

# SC8 Actions on Metallic Buckets

- Issue = Continued incorrect contention that metallic lifts are more dangerous than “all dielectric” lifts → proposal to prohibit these metallic lifts was defeated but the issue is likely to return
- **Metallic Aerial Devices**
  - Telcordia experience with accidents in bucket trucks are that
    - a) Contact between the person and live energized line/equipment is the main danger and the conductivity of the bucket infrastructure is not a critical factor,
    - b) Buckets with fiberglass/dielectric coverings still have underlying metallic superstructure with electric controls in bucket (i.e., the bucket is not electrically isolated), and
    - c) Contact occurs because the worker has not followed industry rules and best practices for safe operations.
  - Communications jobs often require bucket strength and access to power outlet in bucket that are required for best practice work. When following usual operational and practice safety rules, the metallic buckets are safe in themselves when following appropriate work rules.

# SC8 Actions on Storage Batteries



## ■ Rule 420G – Liquid cell Batteries –

- Keeping up with new battery technologies and a response to incidents
- Lead-Acid, Lead-Calcium VRLA type systems Lead-Selenium
- Ni-Cd (Nickel-Cadmium) ... Ni-MH = Nickel Metal Hydride
- Na-Ni-Cl = Sodium Metal Hydride, sodium-sulfur
- Zn-Br
- Li-ion – lithium ion technologies – large variety of chemistries

## ■ Proposal is to revise Rule 420G as follows:

### G. Liquid-cell Batteries

1. Employees shall ensure natural or forced **ventilation** of the battery area is operational ~~ascertain that battery areas are adequately ventilated before performing work.~~
2. Employees shall ~~should~~ avoid smoking, using open flames, or using tools that may produce sparks in the vicinity of batteries capable of generating **a combustible** gas ~~liquid-cell batteries.~~
3. Employees shall use appropriate **protective devices and equipment** ~~when working on or in the vicinity of batteries. eye and skin protection when handling an electrolyte.~~
4. Employees shall take precautions to ensure batteries terminals or associated exposed energized equipment are **not shorted** and work is not performed in a way that could lead to an **electric shock**. ~~not handle energized parts of batteries unless necessary precautions are taken to avoid short circuits and electrical shocks.~~

NOTE: See Section 14 for guidance on battery installations.





# General Issues

# Demarcation Between Codes

Electrical Supply ..... Telecommunications

Service Points ..... Network Interface

\*\*\*\*Utility Defined Demarcation Point\*\*\*\*

- Residence
  - Outside of house – Network Interface Device (NID)/Optical Network Unit (ONU)
  - AC Panel inside house
- Commercial Building
  - Building Entrance Terminal (BET – inside or outside)
  - Telecom Closet or Room
  - AC Panel or power Room inside building
- Communications Nodes - Electronic Hut or Cabinet or Active Fiber Hub
  - Closure Inside Hut
  - Distinct AC compartment in cabinet or separate adjacent box
- Lighting for Parking Area
- Long Rural line serving Remote Farm or Residence
  - At Main Road.....At Property Boundary.....At Buildings



# Other and Competing Codes and Regulations

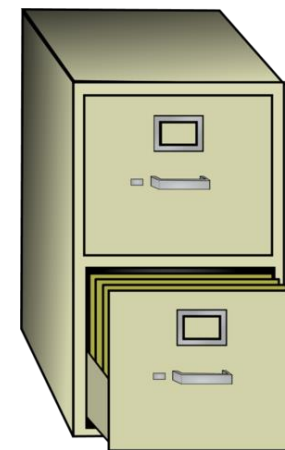
- **Common Objective and Purpose of All Safety Codes**
  - Safety to Workers and Public
  - Regulatory and Legal Compliance – Risk Management
  - Engineering – help ensure practical and useful rules to facilitate safe Joint Use installations and work rules
  - Reliability of Service
- **Continuity of Communications including Cellular Service in times of disaster and emergency (FCC and various State PUCs)**
  - Backup reserve power
  - Duplicate routes
  - During/after Wild Fires
- **Local Variations (e.g., GO 95)**
  - “Will Not Fail” language mismatch with best engineering design
  - Special Fire Zones for increased reliability (?)
  - High Speed Rail – political imperatives



# Operational Concerns in Legal Cases

## ■ Inspections

- Incidental to Regular Work Activities
- Separate Inspection Programs (Frequency?)
- Can be Regulatory or legally driven



## ■ Documentation and Records

- Trouble Report Calls - Response times and Access to Data
- Installation/Maintenance/Repair
- Engineering and Design Records - Pole Loading Analysis

## ■ Practices

- Routine inspections for safety of workers and public
- Corrections of Defects and Reporting of Conditions

# Safety Codes Not Enough

- **Safety Codes.....Regulatory and Legal Mandates**
  - NESC...NEC..OSHA...GO 95....
  - Local and Regional Building and Fire Codes
- **Internal Practices**
  - Telcordia Construction Blue Book – Issue 5 (2011).., new issue in 2015/2106
  - Service Providers - ATT..Verizon... Centurylink ... RUS..
  - Manufacturer/Supplier provided instructions and guidance documents
- **Product Specifications and Functional Performance Criteria**
  - Wireless Facilities – Family of GRs GR-3171,GR-3031, 3032, 3033, 3178
  - Poles & Hardware - GR-60 Wood, GR-3159 Non-Wood, GR-3174 Hardware
  - Equipment - Physical Protection -- GR-3108... GR-1089 EMC.....GR-63
  - Enclosures and Closures - GR-43 (Huts), GR-487 (Electronic Equipment Cabinets), GR-950 (ONUs), GR-902 (Handholes)
  - Cables, .GR-421, GR-3163, GR-3164, GR-137, GR-492, GR-20, etc.....
- **Design Engineering for Network**
  - Reliability and Long Lifetimes --- 20.....40 years
  - Quality and Availability of Services (99.999+%)



# Paths Forward

## A. Develop and submit Comments for NEC

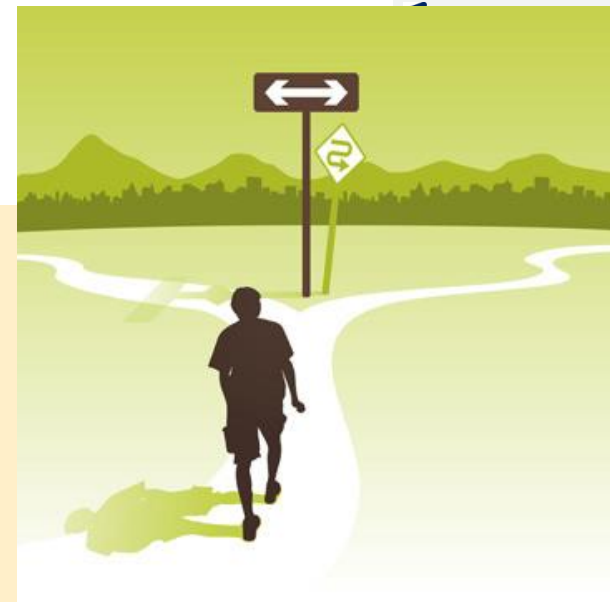
- by Sept. 2015

## B. Develop and submit Comments for NESC

- by May 2015

## C. Develop Guidance Documents

1. SR 1421 – Issue 6 of Construction Blue Book – 2015 or 2016
2. Arc Flash Risk Assessment for Telecom Workers - 2015
3. Position Papers
  - a) Grounding and Bonding – effective grounding for safety and service quality, Intersystem bonding and separate ground beds
  - b) Wireless Facility Designs for Joint Use Structures and DAS Systems
  - c) Service Wire/Drop Issues
  - d) Pole Attachments for wireless/FTTx Facilities – the big and the small



# Possible NEC Comments/Actions

## Support

- IBT – revised definition and 250.94
  - Align Chapter 8 references with new 250.94
- Revised definition of communications equipment
- Article 645 changes – propose further changes?

## Oppose

- The expansion of the Mechanical execution of work from just 300.4(D) to include all of 300.4
- Consolidation of Chapter 8 sections – POTS, CATV, FTTH are different

## Neutral = Monitor Progress

- New Test and inspection section 110.41
- Revised definition of communications equipment
- Review new revised Article 840 particularly on power limitations – suggest higher limits ?
- Monitor for mismatch between NEC and NESC rules

# Possible NESC Comments/Actions

## Support

- New definitions of supply and communications equipment
- Support revision to Rule 97G to help clarify intersystem bonding
- Support new revision to Battery rule 420 G
- Revise 224B to match modified 334
- Changes to 235H – clearances between communications lines
- Retention of Grade N
- Support change to Rule 344
- Support revision to Rule 354D

## Oppose

- Proposals to develop definitions of supply and communications space
- Changes to preferred level Rules 220
- Deletion of exemption for 60 ft pole
- Any proposal to prohibit metallic buckets

## Neutral = Monitor Progress

- Monitor GO 95 activities for new ideas to avoid or those to emulate
- Attend NESC Summit – better ways to use NESC to support telco industry
- Review Guy and insulator (215), Guy marker (217) and Vegetation Mgm (218)
- Monitor “K additive Constant” debate to help ensure consistency
- Support OSHA harmonization efforts for arc flash, fall protection, MAD –Part 4
- Monitor “Structure Conflict” debate

# → Blue Book Revisions and Updates

## Some ideas include

1. Harmonize with changes expected to occur in 2017 NESC
2. Grounding and Bonding
3. Service Drop Plant Attachment, Separation and Clearance.
4. Antenna and Wireless Applications
5. Congestion
7. Make-Safe
8. Excavation Hazards and Precautions
9. Risk Management – Tests and Inspections
10. Pole strength and loading
11. Aerial Bucket Practices
12. Hardware Chapters - update with guidance for GR-3174
13. Powering Architecture Consequences for Wireless facilities
14. Test and Inspections (frequency by geography and plant type)



# THANK YOU

## Q & A

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