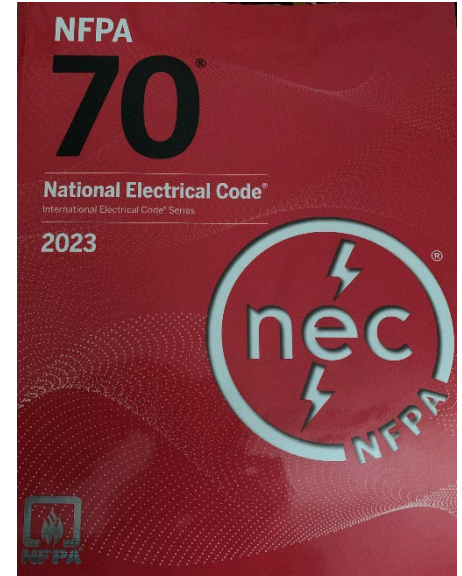


National Electrical Code (NEC) Update

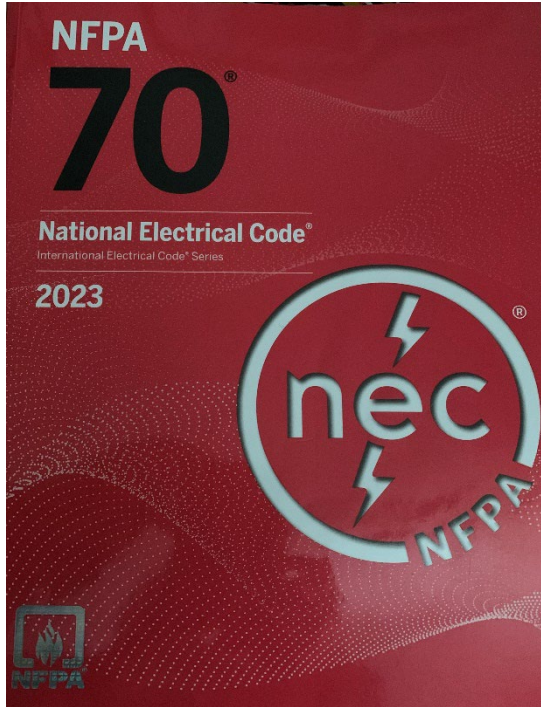


Ernest Gallo

Network Infrastructure Solutions - Ericsson



Codes in Context



California Public Utilities Commission

RULES FOR Overhead Electric Line Construction



- 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, during the installation, operation, and maintenance of electric supply and communication facilities under specified conditions.

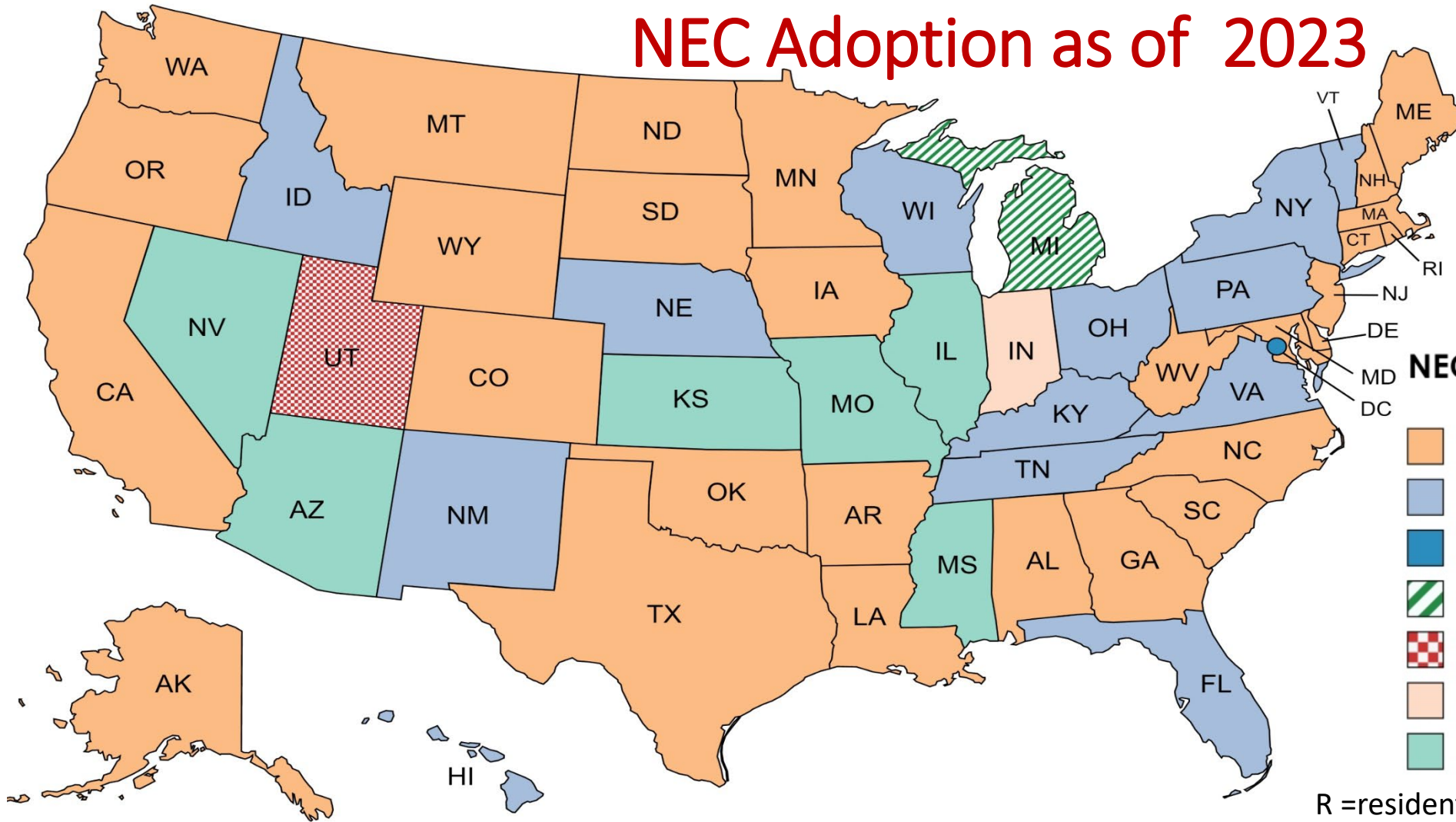
- IEEE = Electrical Safety of Public and Workers

Scope - covers supply and communication facilities and associated work practices employed by an 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

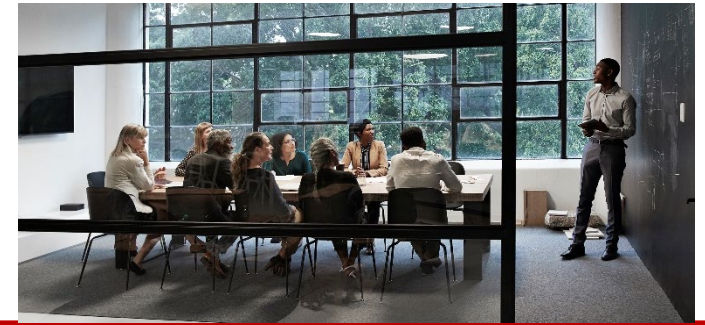
NEC Adoption as of 2023



NEC Adoption by State

- 2020 NEC (28)
 - 2017 NEC (14)
 - 2014 NEC (2)
 - 2014 (R) 2017 (C)
 - 2014 (R) 2020 (C)
 - 2008 NEC (1)
 - local NEC adoptions (6)
- R = residential, C = commercial

NEC (NFPA 70) Representation



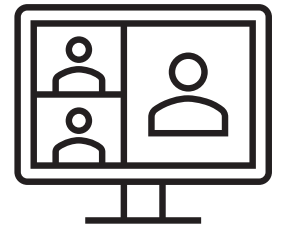
Correlating Committee (CC) and 3 NEC Technical Committees (CMPs)

- **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

- 2023 NEC - published August 2022.
- Several TIAs and Standards Council Motions.
- ➔
- Public Comment and Revisions – due by Sept 7, 2023 for 2026 Code.
- First Draft Meeting -- Jan 15-26, 2024 → First Draft July 2024.
- Second Draft meeting -- Oct 14--26, 2024 → Second Draft March 2025.
- 2026 NEC – to be published August 2025



We anticipate many more frequent and extensive Task Group Meetings prior to, and used in preparation for, the formal meetings



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 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 optical fiber cables

- On balance these changes should be positive for communications industry

Chapter 7 Additions and Changes + NITMAN Fixes

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

- **Article 722** on Cables for Power-Limited Circuits and Fault-Managed Power (**CL4) Circuits** and ~~Optical Fiber~~ - general article taking common requirements and related parts from 725 and 760 for these power circuits often used for communications
- 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

June 2022 – We initiated successful NITMAN motions to the NFPA Standards council to correct errors in 722 and maintain the primacy for 770 for optical fiber applications.

New 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

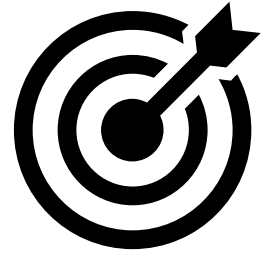
Open Issues based on Correlating Committee and Industry discussions

- Two defeated Proposals will return as PIs for 2026 Code
 - Definition of “Communications Service Point” for a 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" may reduce attacks on independence of Chapter 8.
- Chapter 7 and 8 – The location and independence of these articles and sections will continue to arise as an issue in next code cycles (application of Section 90.3)
- Our current active efforts are designed to consolidate under general Article 800 more and more common of the communications requirements from other articles in Chapters 7 and 8.
- A grand re-structuring of the whole code is being envisioned by some – if it occurs then the consolidation of requirements under Article 800 will help reduce the possible confusion or disruption in code use after a large restructuring.



Background on Proposed Restructuring of NEC

- Industry Trends - New and evolving technologies do not fit current NEC structure
- Medium Voltage - Electrical Systems over 1000V AC / 1500V DC have expanded well beyond utility ownership.
- Multidirectional Power Flow - Distributed Energy Resource technologies are challenging the status of single-direction power flow and connection to a premises or to the utility.
- Communication systems in Chapter 8 are no longer installed or maintained by communication utilities.
- Limited energy systems in Chapter 7/8 are commonplace (no longer “special”) – will have implications of the current NEC Chapters 7 and 8 structure
 - The installation of communications systems is no longer limited to traditional telephone and cable utilities.
 - What was once separate and distinct data systems in Chapter 7 and communication systems in Chapter 8 are being morphed into one overall electrical system complete with communication, signaling, and power, all wrapped into one cable.
 - NEC Users can be confused when trying to determine the applicability of requirements. They need to be able to easily understand and apply the provisions for limited energy circuits.



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.

Ongoing Interactions

State Adoptions-----AHJ discussions

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

Between now and September – review 2023 code for needed and beneficial revisions.

September 2023
Target for new Public Inputs (PIs) for next edition NEC 2026

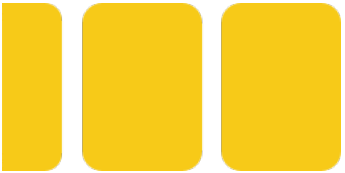


Design – Engineering
Operational M&Ps

Product Listings

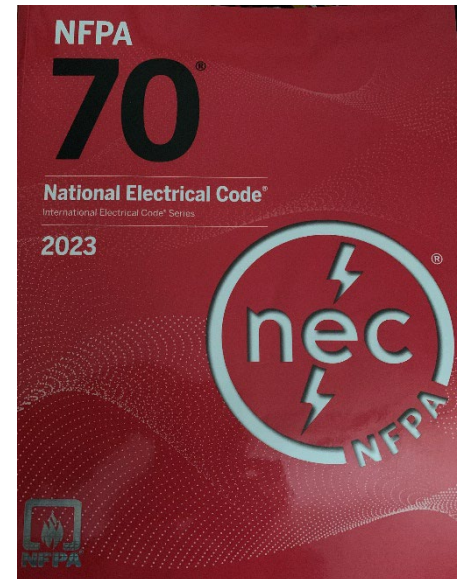
Industry Standards --
Functional Performance
Specifications
GRs, ATIS,...

NFPA Fire and Building Code Project Update



Ernest Gallo

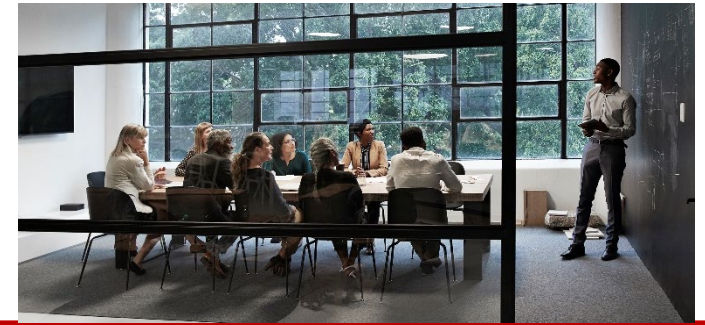
Network Infrastructure Solutions - Ericsson



NFPA Fire & Building Code – Schedule – 2023

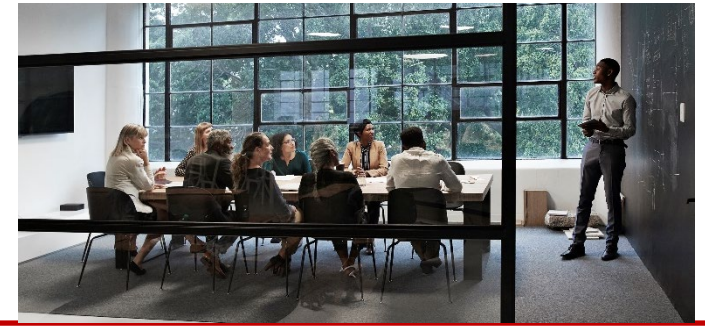
| | PI Due | First Draft | PC Due | 2nd Draft | NITMAM |
|-----------------|------------|-------------|---------|-----------|---------|
| NFPA 72 | 6/1/22 | 3/22/23 | 5/31/23 | 2/28/24 | 3/27/24 |
| NFPA 75 | 1/5/22 | 10/22/22 | 1/4/23 | 10/4/23 | 11/1/23 |
| NFPA 76 | 1/5/22 | 10/22/22 | 1/4/23 | 10/4/23 | 11/1/23 |
| NFPA 1 | 4/1/21 | 12/6/21 | 2/24/22 | 11/17/22 | 1/5/23 |
| NFPA 1225 | Not posted | | | | |
| NFPA 58 | 1/6/21 | 10/27/21 | 1/5/22 | 10/5/22 | 11/2/22 |
| NFPA 855 | 6/1/23 | 3/21/24 | 5/30/24 | 2/27/25 | 3/27/25 |
| NFPA 110/111 | 6/1/22 | 3/22/23 | 5/31/23 | 2/28/24 | 3/27/24 |

NFPA 72 – National Fire Alarm and Signaling Code



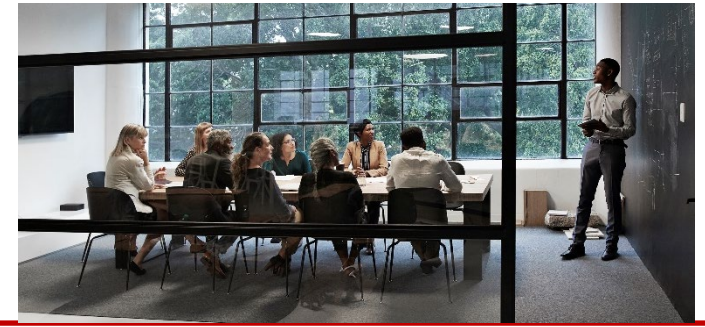
- Ericsson PI to clarify application to communication systems was accepted in last edition.
- A Committee Input was accepted to make all alarm transmissions between protected premises and monitoring stations performance based.
- Two Task Groups were formed: One for POTS transition and one for cloud based enhanced monitoring systems. Ericsson is on both.
- The POTS transition TG has concerns that many POTS alternatives are not suitable for fire alarm transmission.
- The second draft meeting is in July. Publication in 2024.

NFPA 75 - Standard for the Fire Protection of Information Technology Equipment



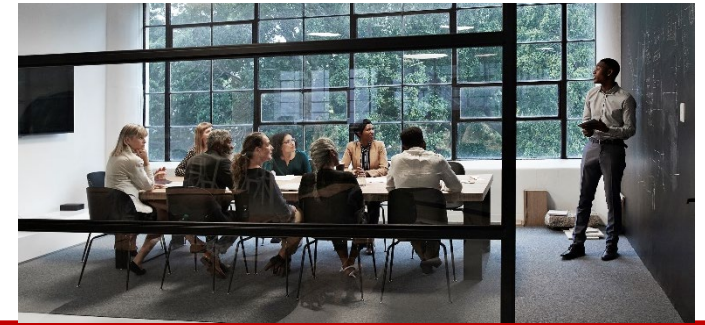
- Ericsson submitted the majority of the Public Input in 2022.
- Most of these were accepted.
- Ericsson is provided additional PCs to be consider at the second draft meeting.
- Publication will be in 2024.

NFPA 76 - Standard for the Fire Protection of Telecommunications Facilities



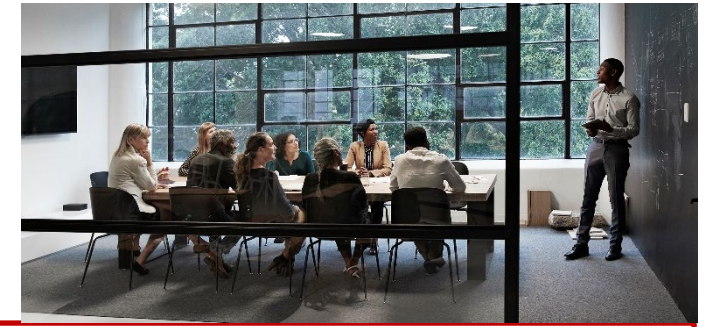
- Ericsson submitted the majority of the Public Input in 2022.
- Most of these were accepted.
- Several TGs are considering additional changes with Ericsson Participation.
- Ericsson is provided additional PCs to be consider at the second draft meeting.
- Publication will be in 2024.

NFPA 1 – Fire Code



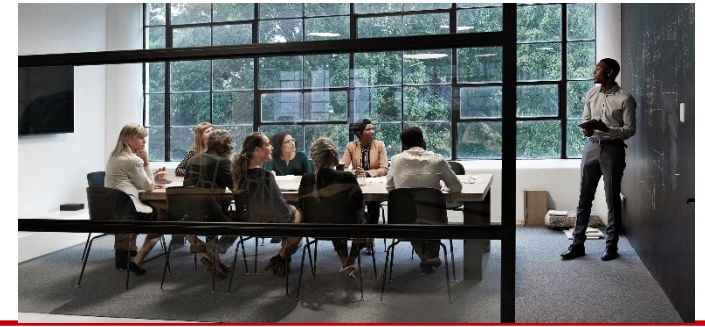
- Ericsson submitted several Public Inputs and Public Comments to address Energy Storage Systems and Stationary Standby Battery Systems.
- Most of these were not accepted.
- The next edition of NFPA 1 will continue to rely on NFPA 855 for regulation of battery installations.
- Publication will be in 2023.

NFPA 1225 - Standard for Emergency Services Communications



- A new edition was published in 2023.
- Ericsson is seeking to:
 - Clarify that the standard does not apply to the telecommunications network as a whole
 - Help to assure emergency communications systems employed by first responders don't interfere with normal telecommunications services.
- Work will begin in 2024 on the next edition.
- The next edition will be published in 2027.

NFPA 58 – Liquid Petroleum Gas Code



- Ericsson made changes in last edition to allow decreased LPG tank spacing at telecom sites to allow for more backup power for cell sites.
- No changes in 2023 edition.
- Ericsson is working with OSHA to have its 1969 era spacing rules updated but OSHA is not very accomodating.

NFPA 855 - Standard for the Installation of Stationary Energy Storage Systems



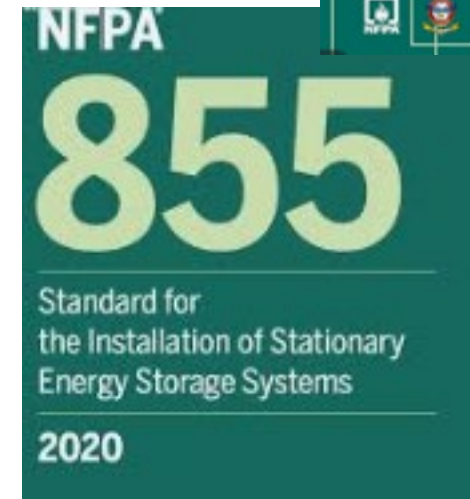
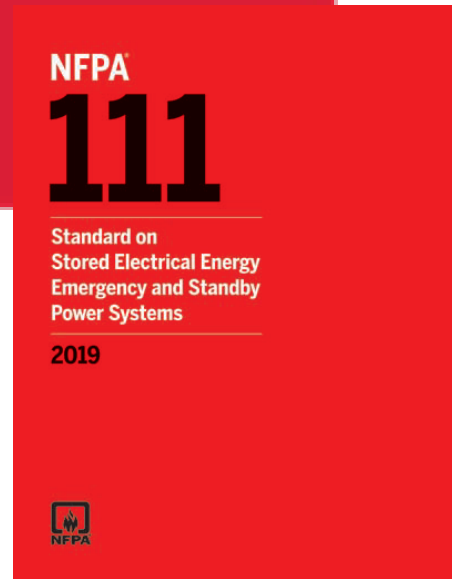
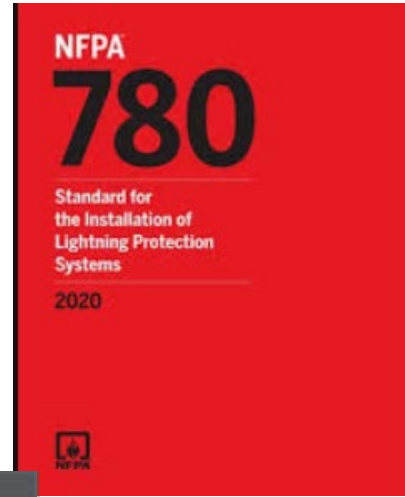
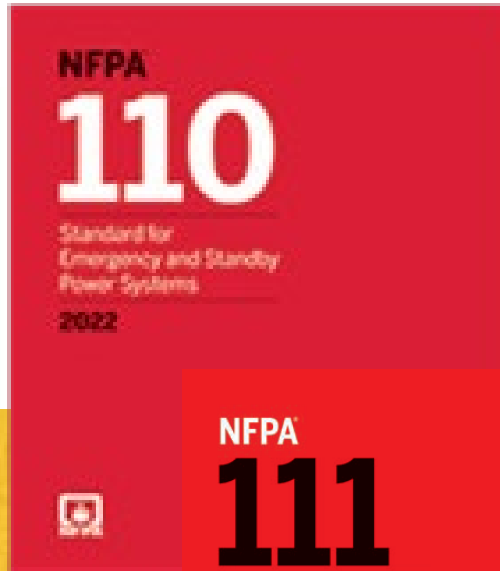
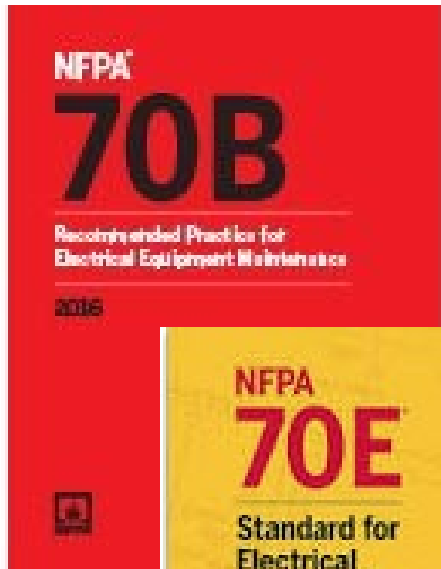
- Monster standard written to address concerns with lithium-ion energy storage systems (residential and utility scale flammable battery systems).
- Stationary standby telecom lead-acid applications are innocent by-standards caught in the crossfire.
- Ericsson has obtained limited exemptions for telecom lead-acid applications.
- More and wider exemptions would be beneficial.
- Work on the next 2026 editions is starting and Ericsson is on several TGs.

NFPA 110 - Standard for Emergency and Standby Power Systems / NFPA 111 - Standard on Stored Electrical Energy Emergency and Standby Power Systems



- These documents are at the Public Comment stage.
- Several Ericsson Public Inputs were accepted to reduce the applicability of these standards to the telecommunications network battery plants and generators.
- The maintenance intervals for Level 2 generators was relaxed.
- More guidance will be submitted as Public Comments.
- These documents mostly deal with Emergency Generators (life safety) and not optional generators.
- Publication will be in 2024.

RELATED NFPA INDUSTRY EFFORTS



RELATED INDUSTRY EFFORTS - EXAMPLES

- GR-1089 – EMC ...GR-63/GR-3108/GR-3171/GR-3178
- UL Listing of Telecommunications Equipment and Devices
- GR-513 – Powering
- ATIS Technical Report 0600040 Fault Managed Power – 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
- Telcordia Construction Blue Book – 2023 Edition - Issue 7 - Chapter 25

