WIRING FOR SAFETY

Navigating the impact of the 2023 NEC Changes on Worker Safety

KYLE KRUEGER

Executive Director, Codes & Standards

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- NEC® - *Correlating Committee*
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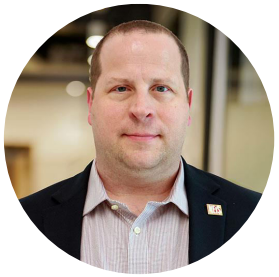
- NFPA 72 – *Correlating Committee*
- NFPA Electrical Section Executive Board
- UL Electrical Council



JEFF NOREN

Manager, Codes and Standards

CODE QUESTION OF THE DAY

DEFINITIONS

Article 100 NEW Definitions

Energized, Likely to Become (Likely to Become Energized) – *Conductive material that could become energized because of the failure of electrical insulation or electrical spacing.*

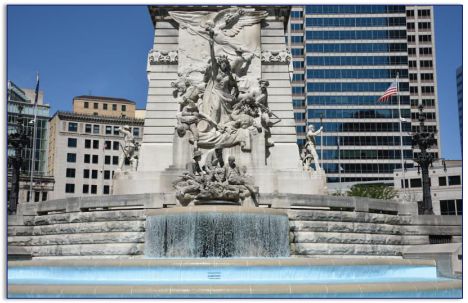
- Used in 25 locations throughout the NEC®

Article 100 NEW Definition

Special Purpose Ground-Fault Circuit Interrupter (SPGFCI) – *A device intended for the detection of ground-fault currents, used in circuits with voltages greater than 150 Volts, that function to de-energize a circuit or portion within an established period of time when a ground-fault current exceeds the values established for Class C, D, or E devices.*

NEW Definitions - SPGFCI

- Traditional GFCI devices are Class A (4-6 mA trip threshold).
- SPGFCIs are used on systems over 150 volts-to-ground.
- SPGFCIs have a hire trip threshold set per their Class listing.



Courtesy of Electrical Training Alliance

Article 100 NEW Definitions

Servicing – *The process of following a manufacturer's set of instructions or applicable industry standards to analyze, adjust, or perform prescribed actions upon equipment with the intention to preserve or restore the operational performance of the equipment.*

NEW Definition - Servicing

- Draws a demarcation line between servicing and reconditioning.
- Supports the new requirement in Section 110.17 on service and maintenance.

ARTICLE 110
GENERAL REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

SECTION 110.3(A) EXAMINATION

- Section 110.3(A) provides examination criteria for AHJs when judging electrical installations/equipment for suitability.
- New (8) added on Cybersecurity for network-connected life-safety equipment.
- AHJ to examine equipment's ability to withstand unauthorized updates and malicious attacks while continuing to perform its intended safety functions.

Courtesy of Electrical Training Alliance

SECTION 110.3(B) INSTALLATION & USE

- Section 110.3(B) has always required electrical equipment to be installed in accordance with installation instructions.
- Revisions now include labeling and identification to listing.
- New Informational Note – allowing the use of a QR Code on equipment label to provide installation instructions.

SECTION 110.16(A) ARC-FLASH HAZARD WARNING

(A) Requires a general warning label on electrical equipment in other than dwelling units to warn personnel of a potential arc-flash hazard and need for PPE.

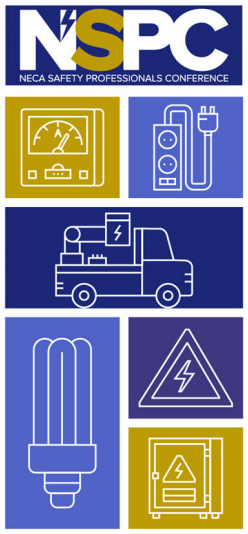
SECTION 110.16(B) ARC-FLASH HAZARD WARNING

- Section 110.16(B) requires a more detailed Arc-Flash warning label for service and now, feeder equipment rated a 1000A or more.
- The label shall be installed in accordance with acceptable industry practice and include the date the label was applied.
- Labels required by both (A) & (B) must comply with Section 110.21(B) which establishes the minimum size and text etc.

NEW SECTION 110.17 SERVICE AND MAINTENANCE

- Servicing and maintenance shall be performed by qualified persons trained in servicing and maintenance of electrical equipment and shall comply with the following:
  - Performed in accordance with manufacturer's installation instructions and listing information, applicable industry standards, or as approved by the AHJ.
  - Performed using identified replacement parts that are verified under applicable product standards.
  - Replacement parts shall comply with at least one of the following:
    - Provided by the OEM
    - Designed by an engineer experienced in the design of replacement parts for the equipment being serviced.
    - Approved by the AHJ.

NFPA 70B – 2023



INSULATING BARRIERS

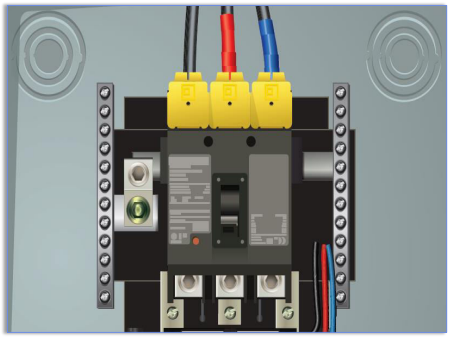
SECTION 215.15 - BARRIERS

- The 2020 NEC® edition required insulating barriers for service panelboards, switchboards, switchgear, etc.
- This requirement has been expanded to feeders for 2023 edition, as a similar hazard exists for this equipment supplied by a feeder/transformer.
- This expansion further demonstrates the ongoing correlation between the NEC® and NFPA 70E.

Courtesy of Electrical Training Alliance

REVISION SECTION 230.62(C) - BARRIERS

- Barriers are required for service equipment to minimize the likelihood of inadvertent contact with uninsulated, and ungrounded, service busbars and terminals.
- This requirement has been revised to make it clear that the requirement applies to protection from contact when the service disconnect is in the open position.
- The conductors and terminals being protected by barriers will remain energized when the service disconnect is in the open position.



Courtesy of Electrical Training Alliance

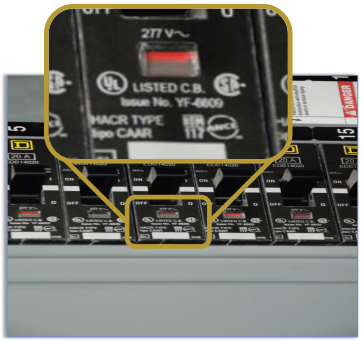
ARTICLE 240 OVERCURRENT PROTECTION

SECTION 240.6(D)
REMOTELY ADJUSTABLE TRIP CIRCUIT BREAKERS

- Adjustable circuit breaker(s) that can be remotely adjusted are permitted.
- The adjusting means shall be permitted to have an ampere rating equal to the adjusted current setting (Long-time pickup setting).
- Remote access shall be achieved by one of the following:
  - Connected directly through a local nonnetwork interface.
  - Connected through a network interface complying either of the following methods:
    - Software/connection has been evaluated for cybersecurity.
    - Cybersecurity assessment of the network is completed. Documentation of the assessment and certification shall be made available to those authorized to inspect, operate, and maintain the system.

SECTION 240.7 - LISTING

- Branch-circuit OCPD are now required to be listed.
- The listing standards include:
  - *UL 499 Standard for Safety: Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.*
  - *UL 1066 Standard for Safety: Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures.*



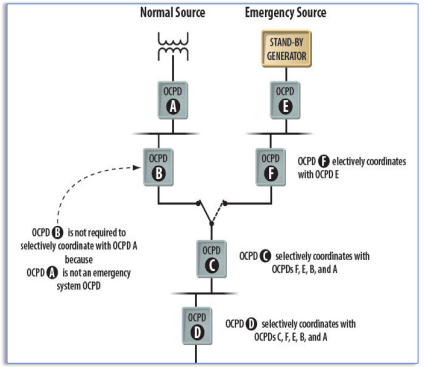
Courtesy of Michael Johnston

SECTION 240.11 SELECTIVE COORDINATION

- NEW Section 240.11 provides general rules on OCPD required to be selectively coordinated.
- By incorporating these rules into Chapter 2 of the NEC® they apply generally to all parts of the NEC® where selective coordination is required.
- Provides much needed clarification on what OCPDs are required to be selectively coordinated with what upstream devices.

SECTION 700.32 – SELECTIVE COORDINATION

- Selective coordination of emergency systems is required to ensure that overcurrent protective device operation does not affect other loads supplied by the emergency systems.
- The text has been revised by adding "load-side" to ensure that coordination applies upstream and downstream.
- New text states that if OCPDs are replaced, modified, deleted, or added, coordination must be reevaluated.



NEW SECTION 240.89 REPLACEMENT TRIP UNITS

- NEW Section added to cover replacement trip units.
- Requires these replacement units to be listed.
- Informational Note clarifying that the replacement trip unit can be one of the following:
  - A listed unit identical to the original.
  - A different trip unit listed for use with a specific circuit breaker.

Courtesy of Electrical Training Alliance

NEC CHAPTER 4

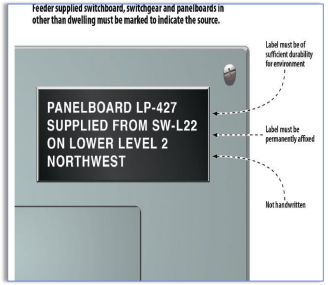
- **SWITCHES**
- **PANELBOARDS**
- **LUMINAIRES**
- **IN WALL HEATING CABLES**

SECTION 210.70

- Revision to Section 210.70 adding language recognizing battery operated switches or wall-mounted control devices.
- While 210.70 permits the usage of these devices, there is a stipulation requiring the device or some means to automatically energize the controlled lighting outlet upon battery failure.
- This raised other concerns about having a battery failure automatically energize the lighting circuit.

SECTION 408.4 DESCRIPTION REQUIRED

- Section 408.4 has been revised from “Field Identification” to Descriptions Required”.
- Circuit directory for all circuits and circuit modification shall be provided with a legible and permanent description complying with the following:
  - Located at each switch or circuit breaker in a switchboard or switchgear.
  - Located in a circuit directory on the face of, inside of, or in an approved location adjacent to then panel door.
  - Clear, evident, and specific to the purpose or use of each circuit including spare positions with an unused overcurrent devices.
  - Described with a degree of detail and clarity that is unlikely to result in confusion between circuits
  - Clear in explaining abbreviations and symbols when used
- All feeder supplied switchboards, switchgear, and panelboards in other than dwelling units, must be marked to indicate the location of the power source.



Courtesy of Electrical Training Alliance

SECTION 408.9 REPLACEMENT PANELBOARDS

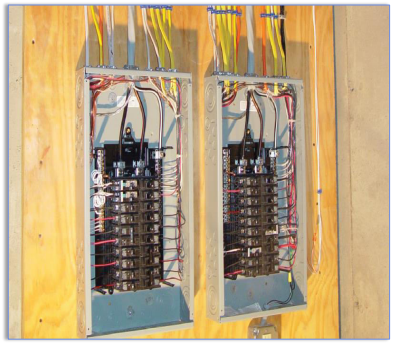
- NEW Section 408.9 has been added to provide requirements for replacement of panelboards.
- The short-circuit current rating of a panelboard is dependent on the enclosure.

(A) Panelboards Listed for the Specific Enclosure can maintain their short-circuit-current-rating if:

- Replacement panelboard must be listed for the specific enclosure.
- Identified by catalog number or dimensional information

(B) Panelboards not Listed for the Specific Enclosure:

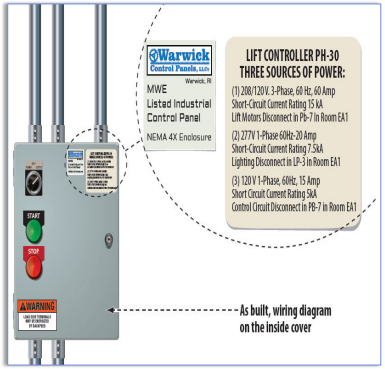
- Available fault current > 10kA will require the completed work to be field labeled.
- Available fault current ≤ 10kA, the replacement panelboard shall be:
  - Identified for the application
  - Any previous listing marks on the cabinet that pertain to the panelboard shall be removed.



Courtesy of Michael Johnston

SECTION 409.110 - MARKING

- The marking requirements for industrial control panels have been clarified.
- Marking attached to the outside of the enclosure:
  - Voltage
  - Number of Phases
  - Frequency
  - Full-Load Current of each incoming supply
  - The location of all sources >50-volts
- Marking required outside or inside the enclosure:
  - Manufacturer name, trademark or other descriptive marking to identify the responsible organization.
  - SCCR established for a listed and labeled assembly; or utilizing an approved method
  - Suitable for use as service equipment (if applicable)
  - Electrical wiring diagram
  - Enclosure type number



Courtesy of Electrical Training Alliance

SECTION 410.71
DISCONNECTING MEANS FLORESENT or LED LUMINAIRES

- Section 410.131(G)(1) was moved to a new Section 410.71
- The requirement has been expanded to include LED luminaire drivers that utilize double-ended lamps.
- LED luminaires are more energy-efficient but can still pose the same shock and electrocution hazards to workers.

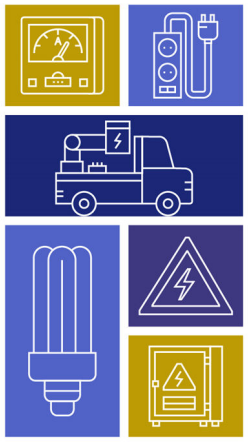
Courtesy of Thomas Garvey and Michael Johnston

SECTION 424.48
INSTALLATION OF HEATING CABLES IN WALLS

- NEW Section 424.48 recognizes a new heating system that consists of heating cable sets or heating panel sets that can be installed in, on, or behind walls.
- New requirement becomes **effective January 1st, 2026**
- Heating cables and cable sets must comply with the following:
  - Identified as suitable for installation in, on, or behind walls.
  - Shall be GFCI and AFCI protected.
  - Approved grounding means required, such as copper braid, metal sheath, or other approved means.
  - Permitted to be installed no more than four (4) feet above the floor.

Courtesy of Electrical Training Alliance

NSPC
NECA SAFETY PROFESSIONALS CONFERENCE



ARTICLE 590
TEMP WIRING

SECTION 590.8 - TEMP POWER OCPDs

- A new requirement has been added for wye-connected temporary service installations of more than 150 volts to ground, but not more than 1000 volts, phase-to-phase.
- If the available fault-current exceeds 10,000 amperes, the OCPD is required to be current-limiting.
- Where available fault current is less than 10 kA, conventional OCPDs will operate quickly enough to clear a fault before damage occurs.

Courtesy of Electrical Training Alliance

NECA

ALTERNATIVE POWER SOURCES

SECTION 445.19(A) EMERGENCY SHUTDOWN OF PRIME MOVER

GENERAL

- New Section 445.19 requires provisions for emergency shut down of a generator prime mover that complies with the following:
  - Be equipped with provisions to disable all prime mover start control circuits rendering it incapable of starting.
  - Initiate a shutdown mechanism that requires a mechanical reset.
- Emergency shutdown can also satisfy the requirements of 445.18 where capable of being locked in the open position.

SECTION 445.19(B) EMERGENCY SHUTDOWN OF PRIME MOVER

REMOTE EMERGENCY SHUTDOWN

- For other than one- and two- family dwelling unit generators rated >15 kW shall be provided with remote emergency stop switch in accordance with the following:
  - Shall meet the requirements of 445.19(A)(1)&(2)
  - Shall be located outside of the equipment room or generator enclosure
  - Shall be in a readily accessible location
  - Shall be permitted to be mounted to the exterior of the generator enclosure
  - Shall be labeled “Generator Emergency Shutdown” and label shall comply with Section 110.21(B)

Courtesy of Electrical Training Alliance

SECTION 445.19(C) EMERGENCY SHUTDOWN OF PRIME MOVER

ONE- AND TWO-FAMILY DWELLING UNITS

- For other than cord-and-plug-connected portable generators, an emergency shutdown device is required in compliance with the following:
  - Located outside the dwelling unit
  - Shall be readily accessible
  - Shall meet the requirements of 445.19(A)(1)&(2)
  - Shall be permitted to be mounted on the exterior of the generator enclosure
  - Shall be marked as the “Generator Emergency Shutdown” and the label shall comply with Section 110.21(B)

Courtesy of Electrical Training Alliance

SECTION 625.49 – ISLAND MODE

- NEW Section 625.49 added to cover EVSE and EVPE with a power export function.
- EVPE and EVSE is now permitted to be part of an interconnected power system that operates in island mode.
- Some electric vehicle installations can function as optional standby power systems.
- The rest of the connected system must be capable of operating in island mode.

Courtesy of Electrical Training Alliance

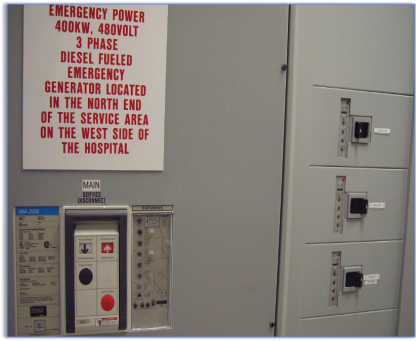
SECTION 690.12
RAPID SHUTDOWN OF PV SYSTEMS ON BUILDINGS

- Section 690.12 establishes the requirements for rapid shutdown of PV Systems on buildings.
- A new Exception was added to exempt non-enclosed detached structures, such as those that provide parking shade, carports, solar, trellises, and similar structures.
- This exception aligns with requirements for firefighter rooftop access in the building and fire codes.

Courtesy of Electrical Training Alliance

SECTION 705.10
IDENTIFICATION OF POWER SOURCES

- The identification requirements have been reorganized into list format.
- The plaques, labels, or directories are now required to indicate the emergency telephone numbers of off-site entities that service the installation.
- A reference was added to *NFPA 1: Fire Prevention Code*, which provides installer information.



Courtesy of Michael J. Johnston

SECTION 705.11
SOURCE CONNECTIONS TO A SERVICE

- The title of 705.11 was revised to make it clear that it refers to any connection of an interconnected source to a service.
- The requirements for service conductors were moved to 705.11(B).
- The former 705.11(D) was relocated to (C) and was completely rewritten.
- The new 705.11(E) was added to provide requirements for bonding and grounding.

Courtesy of the National Renewable Energy Laboratory

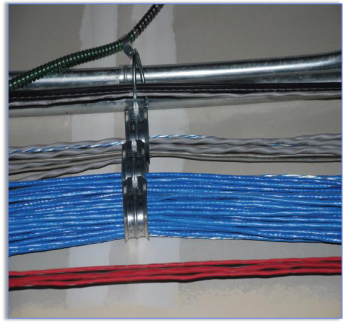
SECTION 705.20
SOURCE DISCONNECTING MEANS

- Section 705.20 provides requirements for disconnecting means for interconnected electric power production sources.
- Most articles that cover power sources also include disconnecting means requirements.
- If an installation complies with 705.20, a single disconnecting means is permitted to disconnect multiple sources.

LIMITED-ENERGY INSTALLATIONS

NEW ARTICLE 722
CABLES FOR POWER-LIMITED & FAULT-MANAGED POWER CIRCUITS

- A new Article 722 has been created to cover cable requirements for Class 2 and 3 power-limited circuits, power-limited fire alarm circuits, and Class 4 fault-managed power systems.
- Many of the installation requirements for these types of cables were repeated in Articles 725 and 760.
- Part I provides general requirements for power-limited circuit conductors and cables.
- Part II covers listing requirements for conductors and cables.
- The requirements for Class 4 circuits are new for this cycle.



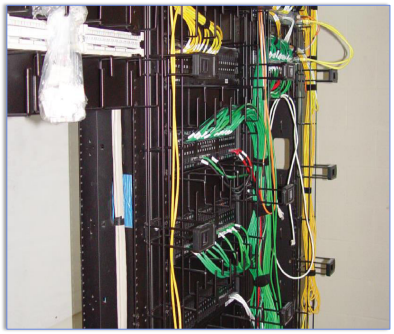
Courtesy of Michael J. Johnston

NEW ARTICLE 724
CLASS 1 POWER-LIMITED CIRCIUTS

- Class 1 **Power-Limited** circuit requirements have been moved from Article 725 to the new Article 724.
- Class 1 circuits are now limited to not more than 30 volts and 1,000 volt-amperes.
- **Non-Power-Limited** Class 1 & Remote Control & Signaling circuits are now covered by the first four chapters of the *Code*.

ARTICLE 725
CLASS 2 & CLASS 3 POWER-LIMITED CIRCUITS

- With the requirements for Class 1 circuits moved to Article 724, Article 725 now only covers Class 2 and 3 Power-Limited circuits.
- General cable requirements of Class 2 and 3 circuits have been relocated to new Article 722.

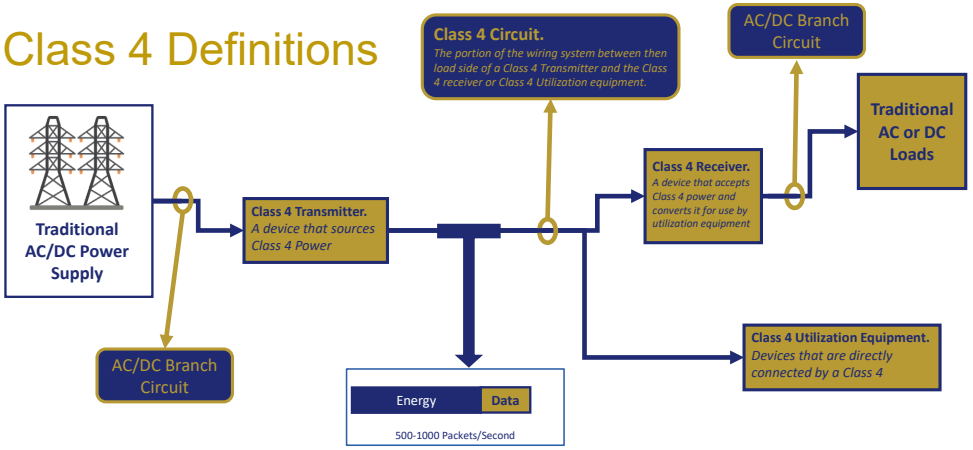


NEW ARTICLE 726
CLASS 4 FAULT MANAGED POWER SYSTEM

- A new Article 726 has been created to cover requirements for Class 4 Fault-Managed Power Systems.
- Fault-managed power systems monitor the circuit for faults and control power delivery to ensure that fault energy is limited.
- Class 4 circuits can have a peak output voltage of 450 volt.

Courtesy of Michael J. Johnston

Class 4 Definitions



QUESTIONS

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