Changes to the 2017 National Electrical Code

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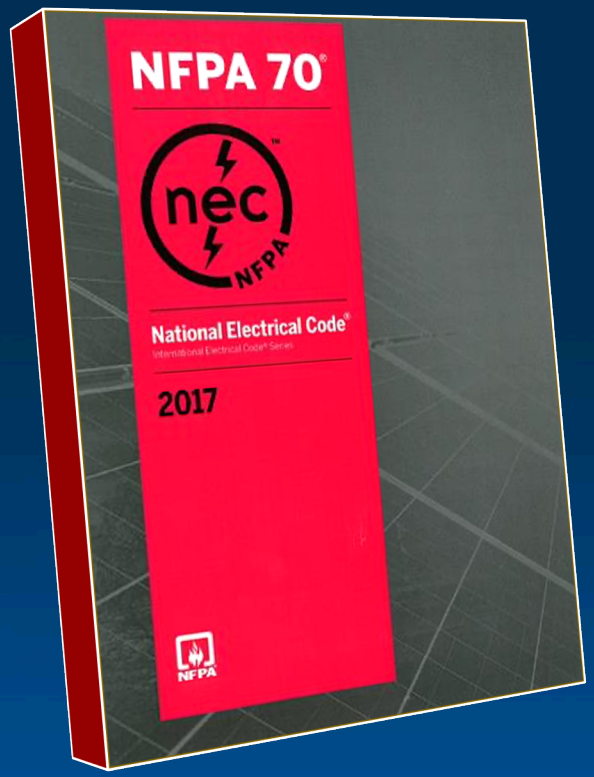
- They cannot provide formal interpretations of NFPA® documents
- It is strongly recommended that YOU refer to the entire text of the NEC ® and NFPA 70E ® standards for a more complete understanding of the MINIMUM requirements for electrical installations and safety.



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The 2017 NEC® Process

- There were 4,012 public inputs (PI).
- 1235 First Revisions (FR) resulted.
- 1513 Public Comments were submitted and 559 Second Revisions (SR) were produced.
- There were 9 articles proposed and 5 new articles appear in the 2017 NEC.

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- Mark Earley

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Glossary of Terms | Learn and apply

IEC PRIDE

New Article 691 Large-Scale PV

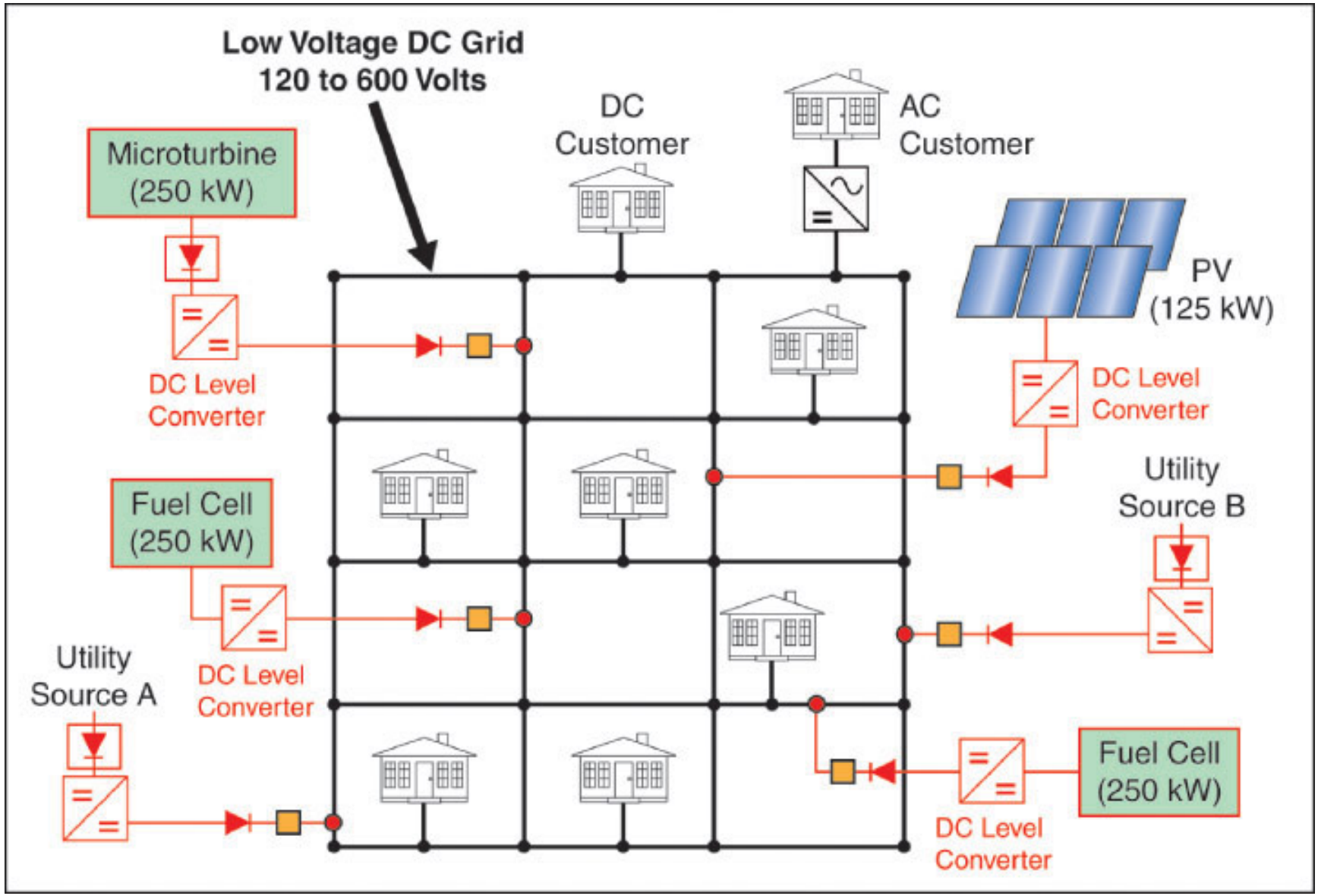
- Large-scale photovoltaic (PV) ≥ 5 mW
- Solar “Farms”
- Supplies power into the electricity grid, rather than premises wiring system
- Equipment is on the load side of the service point
- Service point is the point of connection of the PV generation to the electric utility.

New Article 706

- Energy Storage Systems (ESS)
- Device or devices assembled together capable of storing energy for use at a future time
- Applies to all permanently installed energy storage systems (stand-alone or interactive)
- ESS' include electrochemical storage devices (i.e. batteries), flow batteries, capacitors, ultracapacitors and kinetic energy devices (i.e., flywheels and compressed air).

New Article 712

- Direct Current Microgrids
- Direct current power distribution system consisting of one or more interconnected DC power sources, DC-DC converters, DC loads, and AC loads powered by DC-AC inverters.
- DC power sources to direct current loads such as LED lighting, communications equipment, computers & servers, variable-speed motor drives, HVAC equipment, etc.


Low Voltage DC Grid
120 to 600 Volts
DC
Customer
AC
Customer
Microturbine
(250 kW)
PV
(125 kW)
DC Level
Converter
DC Level
Converter
Utility
Source B
Fuel Cell
(250 kW)
DC Level
Converter
Utility
Source A
Fuel Cell
(250 kW)
DC Level
Converter

Changes to the 2017 National Electrical Code

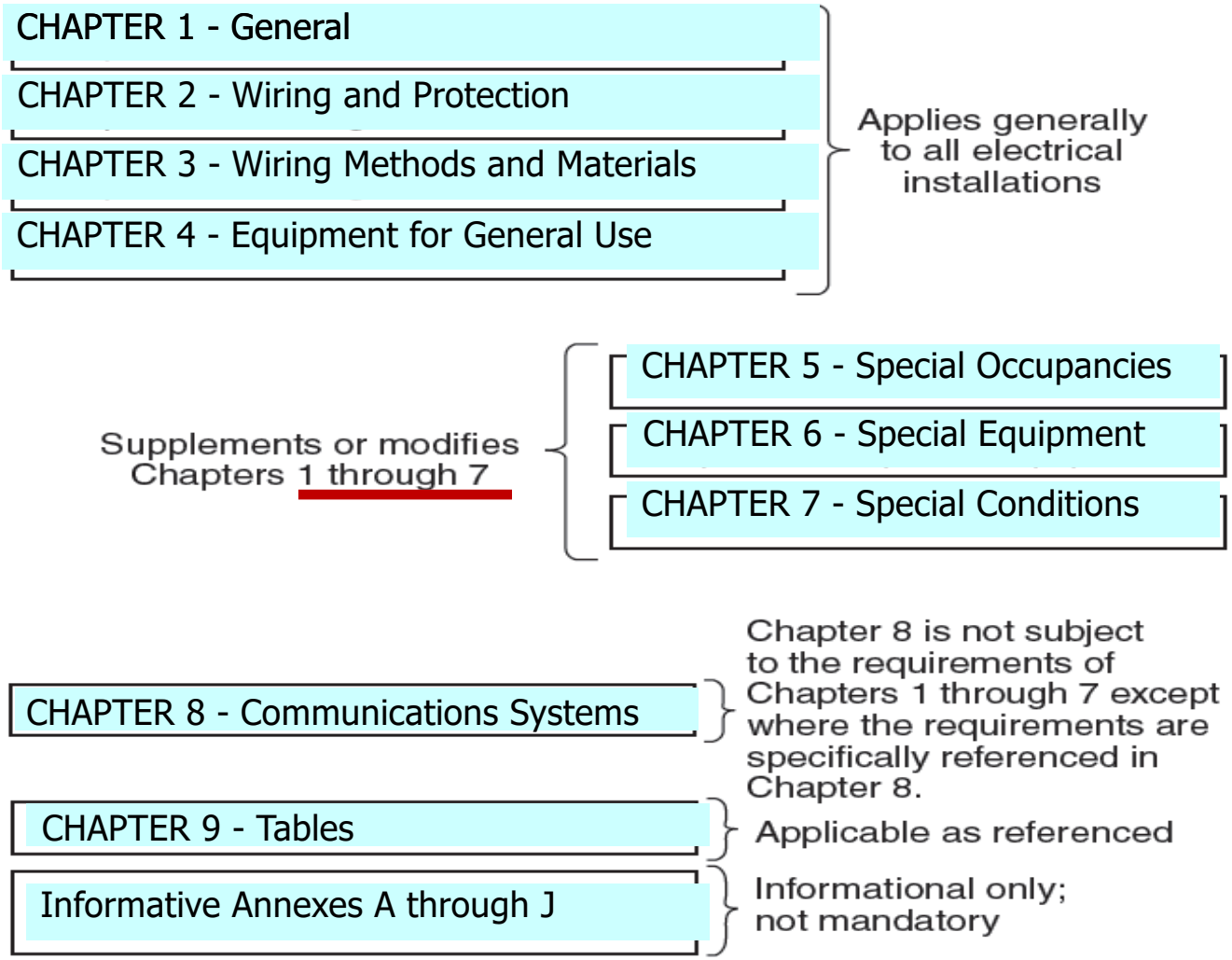
Chapter 1

Section 90.3 Code Arrangement

- 90.3 Code Arrangement. This Code is divided into the introduction and nine chapters, as shown in Figure 90.3. Chapters 1, 2, 3, and 4 apply generally. Chapters 5, 6, and 7 apply to special occupancies, special equipment, or other special conditions and may supplement or modify the requirements in Chapters 1 through 7.

- Chapters 5 - 7 may supplement or modify the general requirements in Chapters 1 through 7 (not just Chapters 1 - 4) as in previous codes.

Section 90.3 Code Arrangement



90.2(A)

(A) Covered.

This Code covers the installation and removal of electrical conductors, equipment, and raceways; signaling and communications conductors, equipment, and raceways; and optical fiber cables and raceways for the following:

- (1) Public and private premises….
- (2) Yards, lots, parking lots, carnivals….
- (3) Installations of conductors and equipment that connect to the supply of electricity
- (4) Installations used by the electric utility, such as office buildings…

90.2(B)

(B) Not Covered.
This *Code* does not cover the following: ….

(3) Installations of railways for generation, transformation, transmission, energy storage, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communications purposes.

(4) ……

(5) Installations under the exclusive control of an electric utility where such installations Consist of service drops or service laterals, and associated metering, or,

a. Are on property owned or leased by the electric utility for the purpose of communications, metering, generation, control, transformation, transmission, energy storage, or distribution of electric energy, or…….

Definitions Relocated

- Multiple definitions previously located in 500.2 have been relocated to Article 100.
- Section 2.2.2.1 of the NEC Style Manual requires that if a term appears in more than two articles is shall be included in Article 100.
- The words “as applied to Hazardous (Classified) Locations” have been added following each relocated defined term, but before the definition.

Definition: Readily Accessible

Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth. (CMP-1)

Informational Note: Use of keys is a common practice under controlled or supervised conditions and a common alternative to the ready access requirements under such supervised conditions as provided elsewhere in the NEC.


Power
Generation
www.cumminspower.com

Definition: Structure

Structure. That which is built or constructed, other than equipment.

- Clarifies that equipment is not a structure, but could be mounted to a structure.

EV CHARGING STATION
EV CHARGING STATION


I E C
PRIDE

Definition: Building

Building. A structure that stands alone or that is separated from adjoining structures by fire walls. (CMP-1)

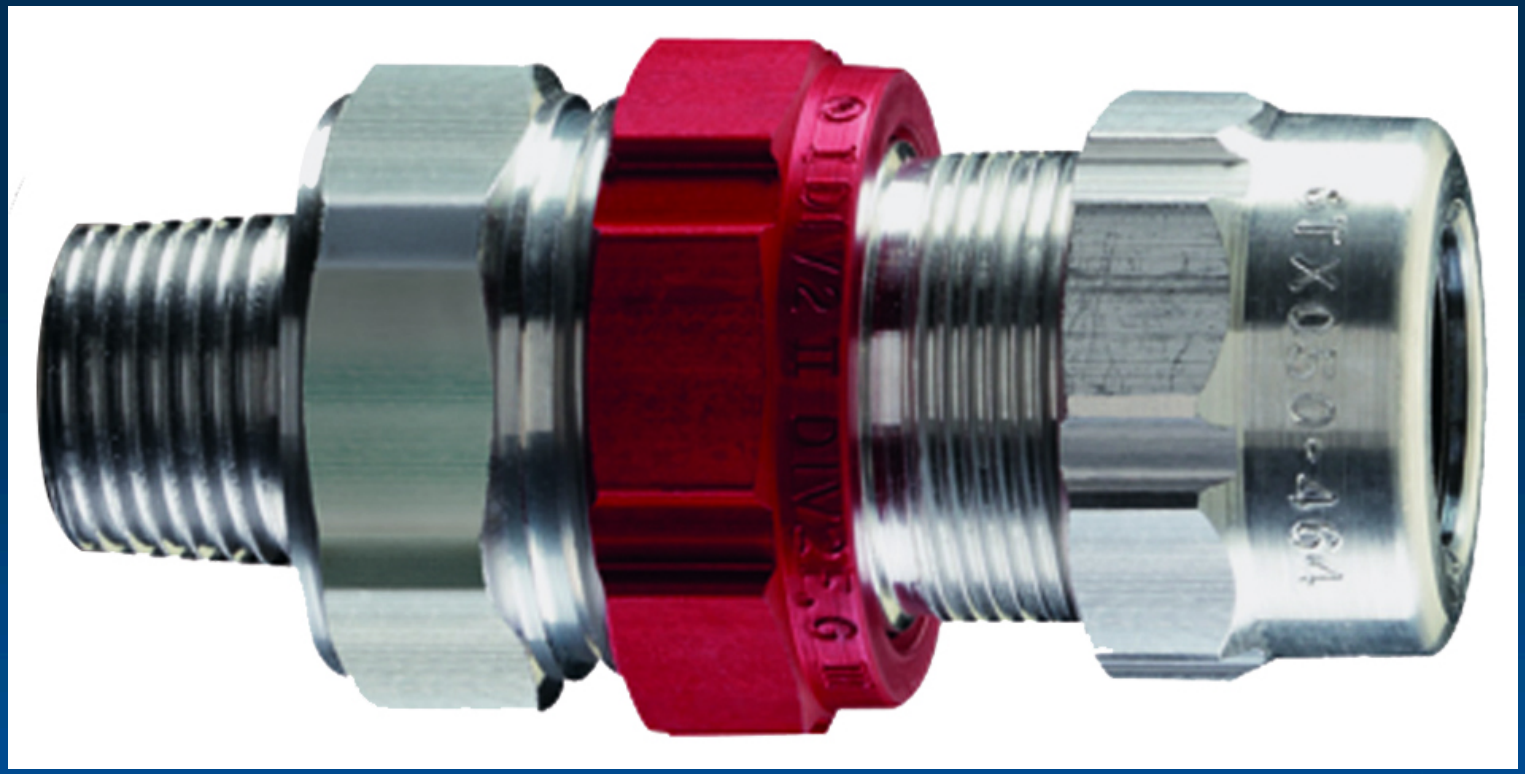
- The words “with all openings therein protected by approved fire doors” and “cut off” have been removed from this definition.
- The word “separated” replaces the words “cut off.”
- The term “firewall” already implies that any openings such as windows and doors would be required to be fire rated.

Definition: Cord Connector

Cord Connector [as applied to Hazardous (Classified) Locations].
A fitting intended to terminate a cord to a box or similar device and reduce the strain at points of termination and may include an explosionproof, a dust-ignitionproof, or a flameproof seal. (CMP-14)

- A new definition of "Cord Connector [as applied to hazardous (classified) locations]" has been added to Article 100.
- This term was previously undefined, yet appears in multiple general NEC articles including those covering hazardous (classified) locations.
- There is currently no definition for the term "cord connector(s)" appearing in NEC Chapters 1 through 4.

Hazardous Location Cord Connector Example



Definition: Dusttight

Dusttight. Enclosures constructed so that dust will not enter under specified test conditions. **(CMP-14)**

- See two informational notes.
- The definitions of “Dusttight” and associated Informational Notes previously located in Sections 500.2 and 506.2 have been deleted.
- The existing definition “Dusttight” in Article 100 has been revised to incorporate the concepts contained in the deleted dusttight definitions formerly in 500.2 and 506.2.
- The revision achieves compliance with Section 2.2.2.1 of the NEC Style Manual.

Crouse-Hinds Division of Cooper Industries

www.ieci.org

Definition: FEB and Field Labeled

Field Evaluation Body (FEB). An organization or part of an organization that performs field evaluations of electrical or other equipment. [NFPA 790, 2012]

Field Labeled (as applied to evaluated products). Equipment or materials to which has been attached a label, symbol, or other identifying mark of an FEB indicating the equipment or materials were evaluated and found to comply with requirements as described in an accompanying field evaluation report. [NFPA 790, 2012]

Definition: Interactive Inverter

~~Utility~~ Interactive Inverter.

An inverter intended for use in parallel with an electric utility to supply common loads that may deliver power to the utility.

Definition: Receptacle

Receptacle. A contact device installed at the outlet for the connection of an attachment plug, or for the direct connection of electrical utilization equipment designed to mate with the corresponding contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke. (CMP-18)

Definition: Substation

Substation.
An assemblage of equipment (e.g., switches, interrupting devices, circuit breakers, buses, and transformers) through which electric energy is passed for the purpose of distribution, switching, or modifying its characteristics. (CMP-9)

- The previous definition of “Substation” has been relocated from Part I to Part II.
- The definition has been revised to clarify its physical characteristics and how it is usually intended to perform.

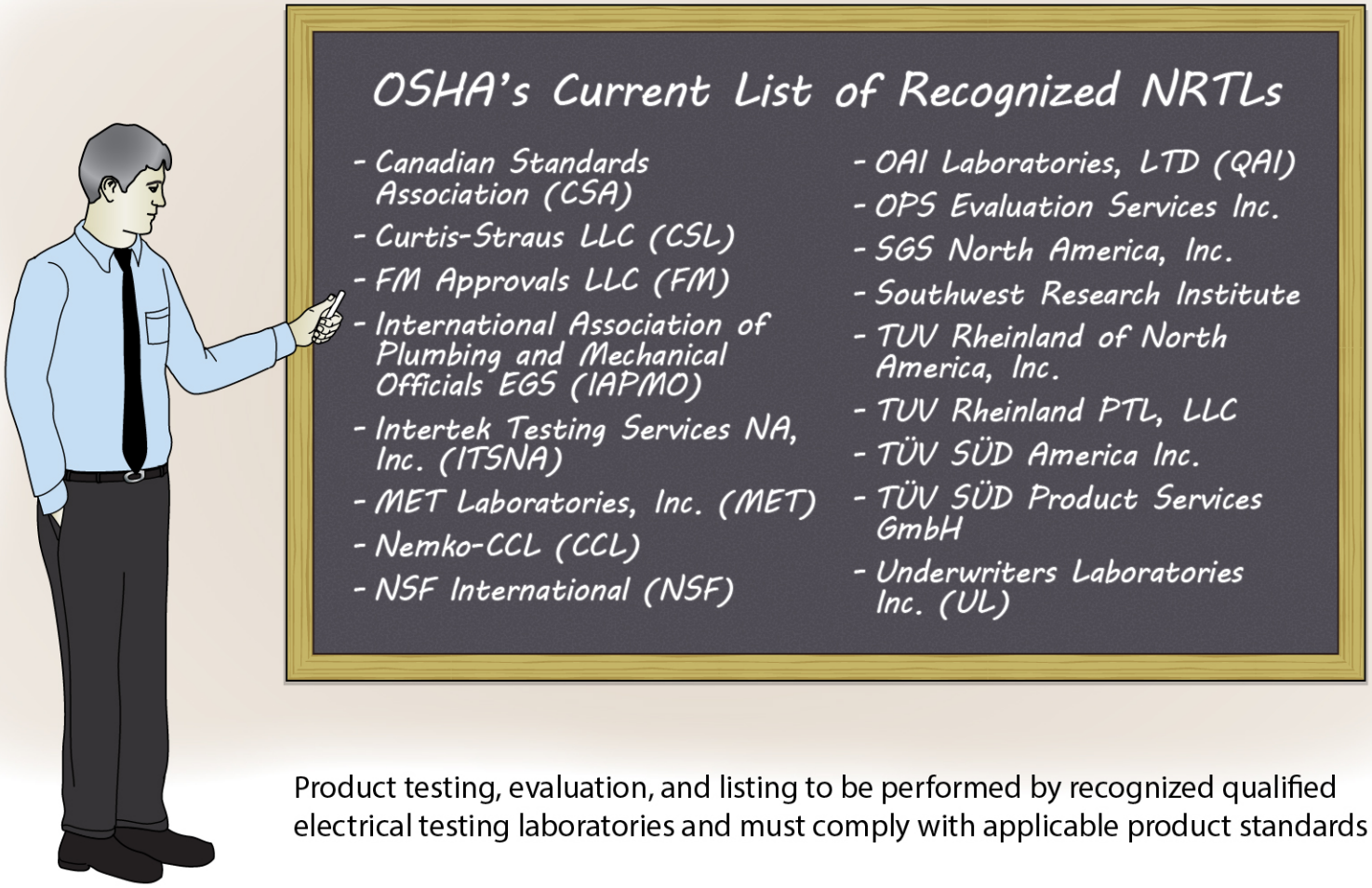

I E C
PRIDE

Title Change 110.3

110.3 Examination, Identification, Installation, Use, and Listing (Product Certification) of Equipment.

- The title of 110.3 has been revised to include listing (product certification).
- A new Subdivision (C) and associated informational note have been added to Section 110.3.
- The revision clarifies that listing (product certification) be performed by recognized qualified electrical testing laboratories and the new informational note indicates that OSHA provides a list of such qualified laboratories.

110.3(C) Listing and Informational Note



Product testing, evaluation, and listing to be performed by recognized qualified electrical testing laboratories and must comply with applicable product standards

110.14(D) Torque

(D) Installation.

Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a calibrated torque tool shall be used to achieve the indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

110.16 Arc-Flash Hazard Warning

110.16 Arc-Flash Hazard Warning

(A) General…

(B) Service Equipment. In other than dwelling units, in addition to the requirements in (A), a permanent label shall be field or factory applied to service equipment rated 1200 amps or more. The label shall meet the requirements of 110.21(B) and contain the following information:

(1) Nominal system voltage

(2) Available fault current at the service overcurrent protective devices

Continued on next slide…

110.16 Arc-Flash Hazard Warning

(3) The clearing time of service overcurrent protective devices based on the available fault current at the service equipment

(4) The date the label was applied

Exception: Service equipment labeling shall not be required if an arc flash label is applied in accordance with acceptable industry practice.

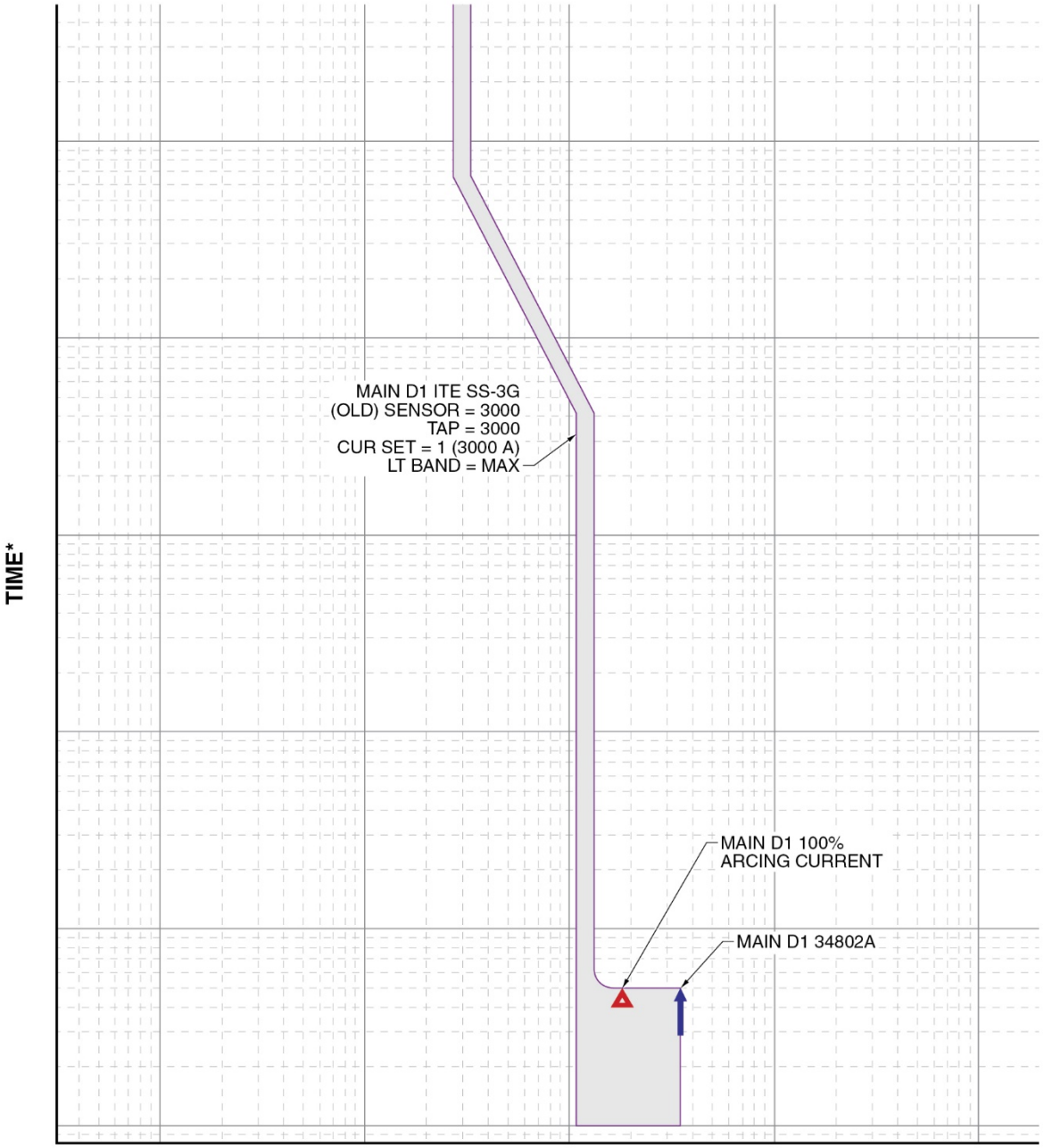
⚠ WARNING!

Arc Flash & Shock Hazard
Appropriate PPE Required

Date Label was Applied _____
Nominal System Voltage _____
Available Fault Current _____
Service Overcurrent Device Clearing Time _____

Arc Flash Boundary _____
At least one of the following: _____
(1) Incident Energy _____ **at working distance of** _____ **or**
Arc Flash PPE Category _____
(2) Minimum arc rating of clothing _____
(3) Specific level of PPE _____

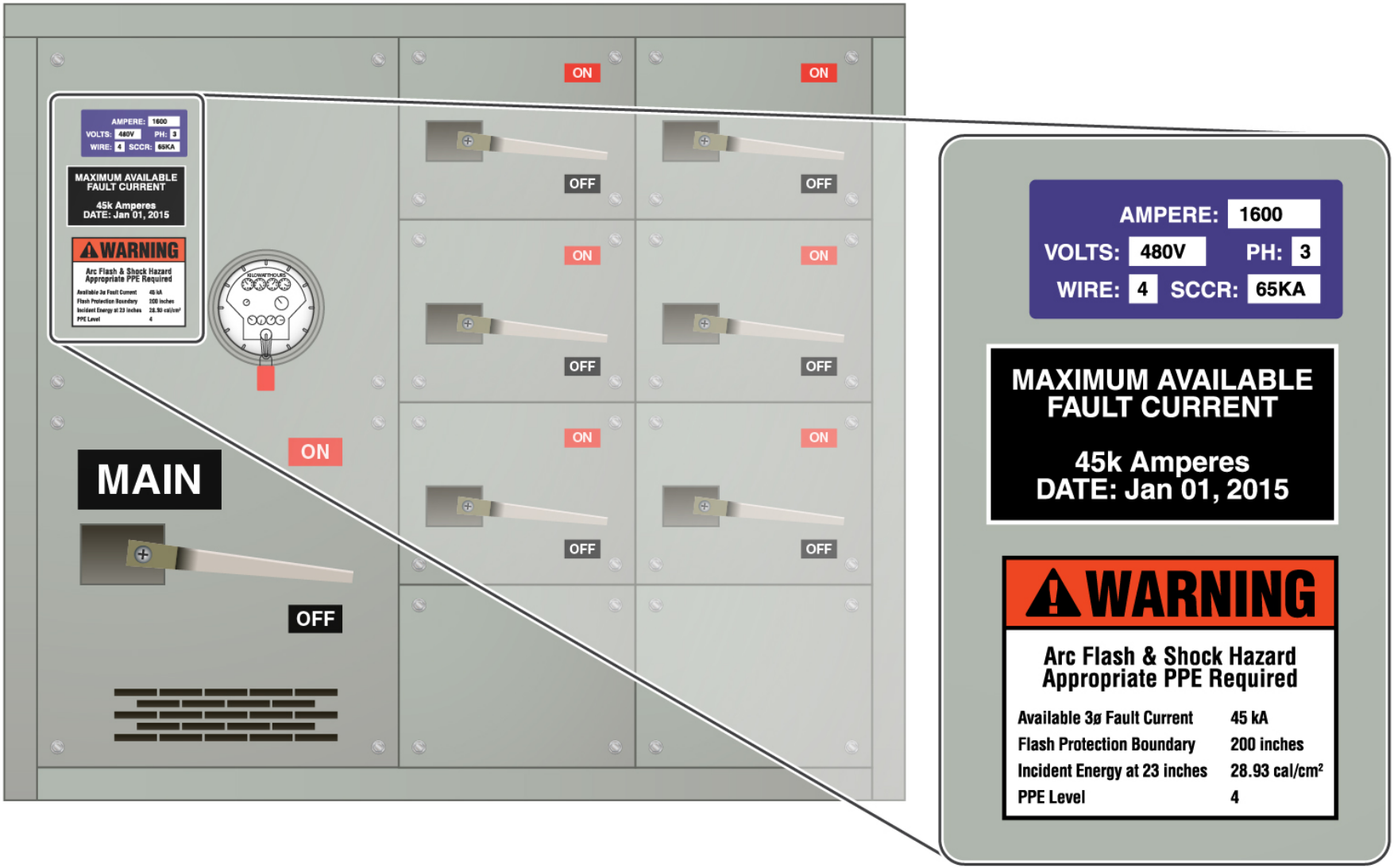
Yellow Highlights indicate arc-flash warning label requirements in the NEC



* in sec
† in A × 100 at 480 V

Table 130.7(C)(15)xxx

Panelboards or other equipment rated 240 volts and below	1	485 mm
Parameters: Maximum of 25 kA available fault current; maximum of 0.03 ~~s~~ sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)		(19 in.)
Panelboards or other equipment rated greater than 240 volts and up to 600 volts	2	900 mm
Parameters: Maximum of 25 kA available fault current; maximum of 0.03 ~~s~~ sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)		(3 ft)
600-volt class motor control centers (MCCs)	4	4.3 m
Parameters: Maximum of 42 kA available fault current; maximum of 0.33 ~~s~~ sec (20 cycles) fault clearing time; minimum working distance 455 mm (18 in.)		(14 ft)
600-volt class switchgear (with power circuit breakers or fused switches) and 600-volt class switchboards	4	6 m
Parameters: Maximum of 35 kA available fault current; maximum of up to 0.5 ~~s~~ sec (30 cycles) fault clearing time; minimum working distance 455 mm (18 in.)		(20 ft)


AMPERE: 1600
VOLTS: 480V PH: 3
WIRE: 4 SCCR: 65KA
MAXIMUM AVAILABLE FAULT CURRENT
45k Amperes
DATE: Jan 01, 2015
WARNING
Arc Flash & Shock Hazard
Appropriate PPE Required
Available 3ø Fault Current 45 kA
Flash Protection Boundary 200 inches
Incident Energy at 23 inches 28.93 cal/cm²
PPE Level 4
BLOWWITHCURE
MAIN
ON
OFF
ON
OFF
ON
OFF
ON
OFF
ON
OFF
ON
OFF
ON
OFF
AMPERE: 1600
VOLTS: 480V PH: 3
WIRE: 4 SCCR: 65KA
MAXIMUM AVAILABLE FAULT CURRENT
45k Amperes
DATE: Jan 01, 2015
WARNING
Arc Flash & Shock Hazard
Appropriate PPE Required
Available 3ø Fault Current 45 kA
Flash Protection Boundary 200 inches
Incident Energy at 23 inches 28.93 cal/cm²
PPE Level 4

110.21(A) Reconditioned Equipment

(A) Equipment Markings.

(1) The manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product can be identified shall be placed on all electrical equipment. Other markings that indicate voltage, current, wattage, or other ratings shall be provided as specified elsewhere in this Code. The marking or label shall be of sufficient durability to withstand the environment involved.

(2) Reconditioned equipment shall be marked with the name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning.

Informational Note: Industry standards are available for application of reconditioned and refurbished equipment.

110.21(A) Reconditioned Equipment

- IF A UL LISTED (CERTIFIED) PRODUCT IS REBUILT, RECONDITIONED, REFURBISHED OR REMANUFACTURED, DOES THE ORIGINAL LISTING (CERTIFICATION) MARK ON THE PRODUCT APPLY TO THE REBUILD?

- No. Rebuilding, reconditioning, refurbishing and remanufacturing all modify a Listed (certified) product. As such, UL does not know if the product continues to comply with our Listing (certification) requirements. The one exception is when a UL Listing or Certification Mark specifically includes references to rebuilding, refurbishing or remanufacturing.

110.24(A)

(A) Field Marking. Service equipment in at other than dwelling units shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault-current calculation was performed and be of sufficient durability to withstand the environment involved. The calculation shall be documented and made available to those authorized to design, install, inspect, maintain, and operate the system.

Informational Note: The available fault-current marking(s) addressed in 110.24 is related to required short-circuit current ratings of equipment. NFPA 70E-2012, Standard for Electrical Safety in the Workplace, provides assistance in determining the severity of potential exposure, planning safe work practices, and selecting personal protective equipment.


Carrier

110.26(A) Limited Access

(4) Limited Access.

Where equipment operating at 1000 volts, nominal, or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized is located in a space with limited access, all of the following shall apply:

(a) Where equipment is installed above a lay-in ceiling, there shall be an opening not smaller than 559 mm × 559 mm (22 in. × 22 in.), or in a crawl space, there shall be an accessible opening not smaller than 559 mm × 762 mm (22 in. × 30 in.).

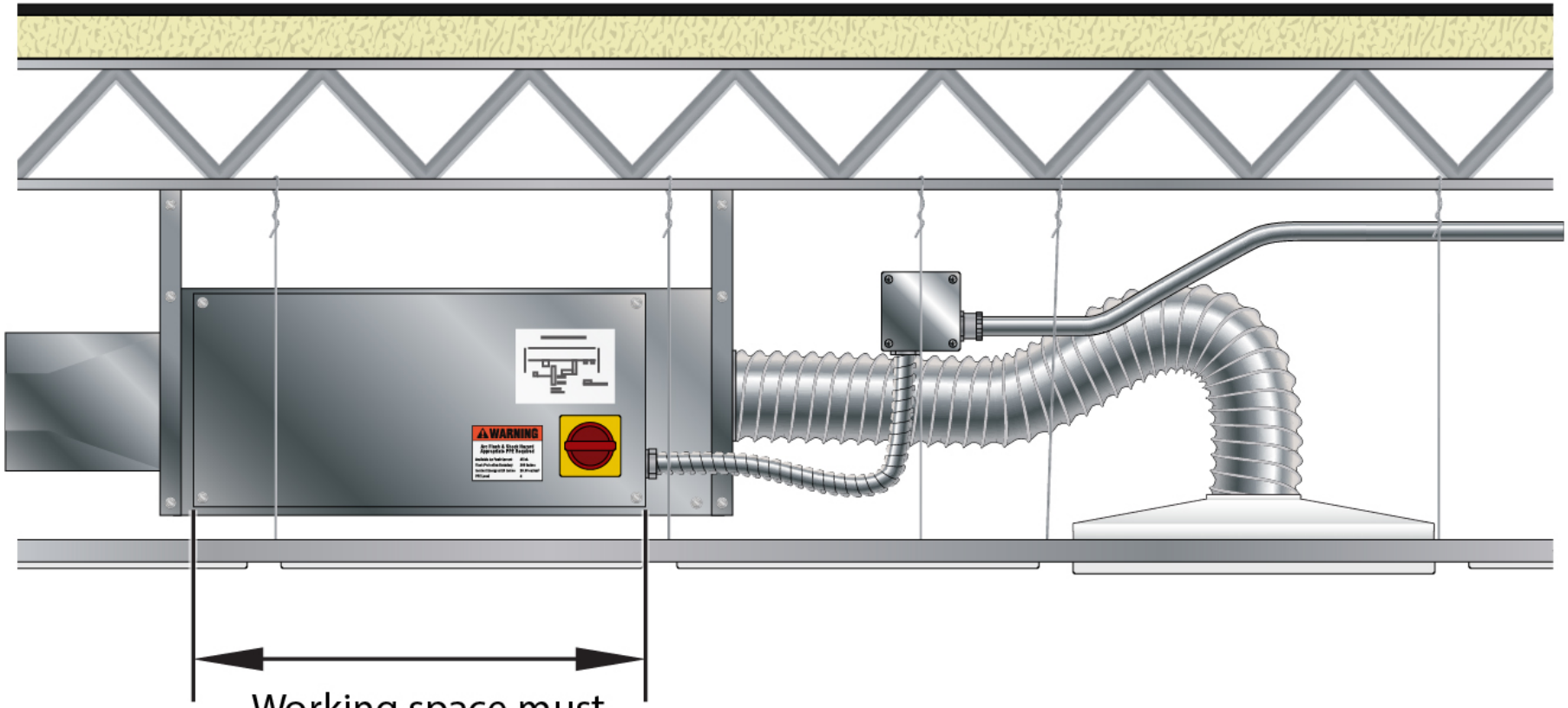
Continued on next slide…

110.26(A) Limited Access

(b) The width of the working space shall be the width of the equipment enclosure or a minimum of 762 mm (30 in.), whichever is greater.

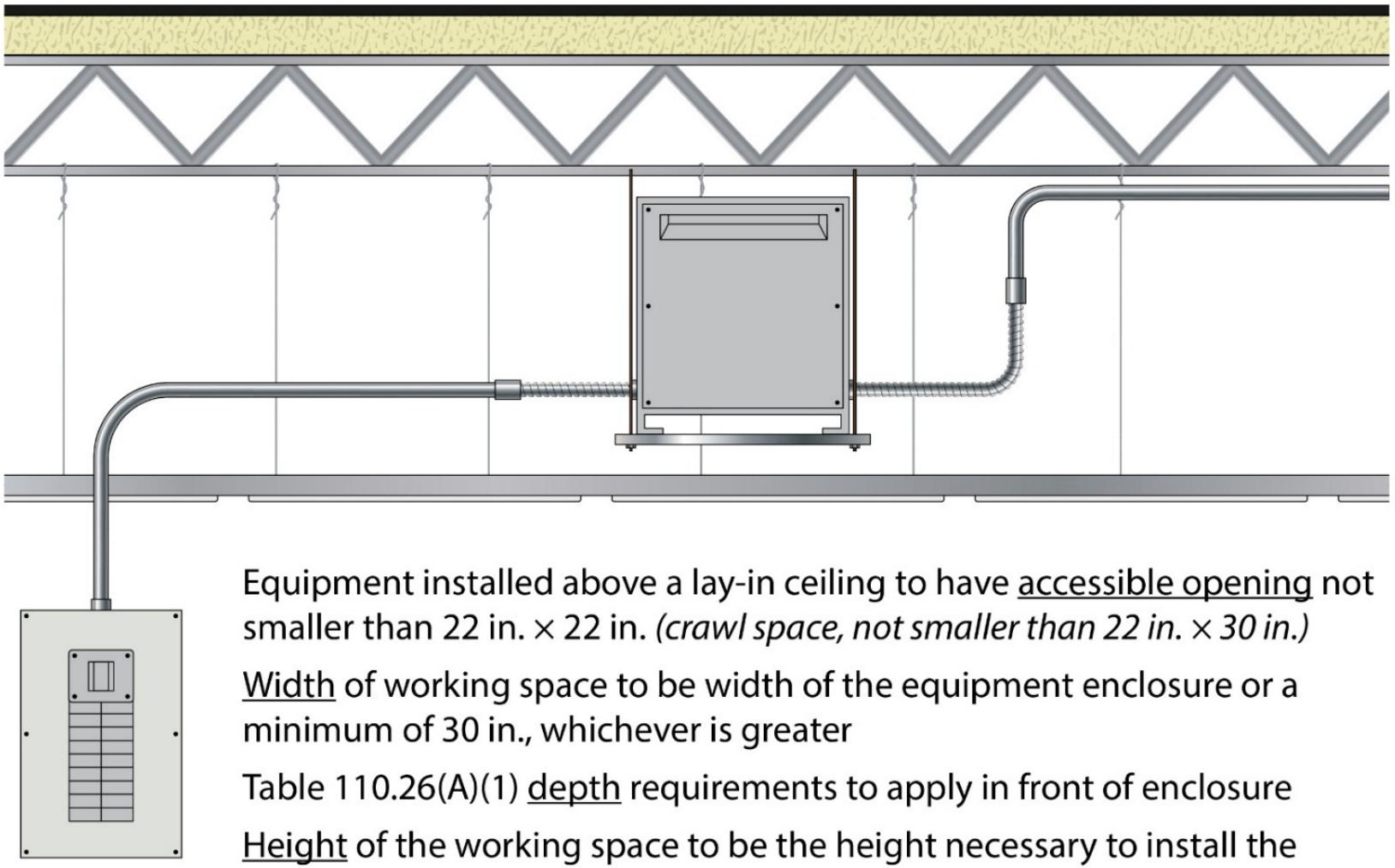
(c) All enclosure doors or hinged panels shall be capable of opening a minimum of 90 degrees.

(d) The space in front of the enclosure shall comply with the depth requirements of Table 110.26(A)(1). The maximum height of the working space shall be the height necessary to install the equipment in the limited space. A horizontal ceiling structural member or access panel shall be permitted in this space.



Working space must be the width of the enclosure or 30 inches, whichever is greater

110.26(A)(4) Limited Access Working Space



Equipment installed above a lay-in ceiling to have accessible opening not smaller than 22 in. × 22 in. *(crawl space, not smaller than 22 in. × 30 in.)*

Width of working space to be width of the equipment enclosure or a minimum of 30 in., whichever is greater

Table 110.26(A)(1) depth requirements to apply in front of enclosure

Height of the working space to be the height necessary to install the equipment in the limited space

Horizontal ceiling structural member/access panel permitted in space

Table 110.26(A)(1) Working Spaces

Nominal Voltage to Ground	Minimum Clear Distance		
	Condition 1	Condition 2	Condition 3
0–150	900 mm (3 ft)	900 mm (3 ft)	900 mm (3 ft)
151–600	900 mm (3 ft)	1.0 m (3 ft 6 in.)	1.2 m (4 ft)
601–1000	**900 mm (3 ft)**	**1.2 m (4 ft)**	**1.5 m (5 ft)**

Note: Where the conditions are as follows:

Condition 1 — Exposed live parts on one side of the working space and no live or grounded parts on the other side of the working space, or exposed live parts on both sides of the working space that are effectively guarded by insulating materials.

Condition 2 — Exposed live parts on one side of the working space and grounded parts on the other side of the working space. Concrete, brick, or tile walls shall be considered grounded.

Condition 3 — Exposed live parts on both sides of the working space.

110.26(E)

Outdoor installations shall comply with 110.26(E)(2)(a) ~~and (b)~~ through (c).

(a) Installation Requirements. Outdoor electrical equipment shall be the following:

(1) Installed in suitable enclosures

(2) Protected from accidental contact by unauthorized personnel, or by vehicular traffic

(3) Protected from accidental spillage or leakage from piping systems

Continued on next slide…

110.26(E)

(b) Work Space. The working clearance space shall include the zone described in 110.26(A). No architectural appurtenance or other equipment shall be located in this zone.

Exception to (b): Structural overhangs or roof extensions shall be permitted in this zone.

(c) ***Dedicated Equipment Space.*** The space equal to the width and depth of the equipment, and extending from grade to a height of 1.8 m (6 ft) above the equipment, shall be dedicated to the electrical installation. No piping or other equipment foreign to the electrical installation shall be located in this zone.


I E C
PRIDE

110.26(D) and 110.33(D) Illumination

(D) Illumination.

Illumination shall be provided for all working spaces about service equipment, switchboards, switchgear, panelboards, or motor control centers installed indoors. Control by automatic means only shall not be permitted. Additional lighting outlets shall not be required where the work space is illuminated by an adjacent light source or as permitted by 210.70(A)(1), Exception No. 1, for switched receptacles.

110.26(F)

(F) Locked Electrical Equipment Rooms or Enclosures. ~~Electrical equipment rooms or enclosures housing electrical apparatus that are controlled by a lock(s) shall be considered accessible to qualified persons.~~

(1) Electrical equipment rooms or enclosures housing electrical apparatus that are controlled by a lock(s) shall be considered accessible to qualified persons.

Continued on next slide…

110.26(F)

(2) The entrance to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at 601 to 1000 volts, nominal, shall be kept locked unless such entrances are under the observation of a qualified person at all times. Permanent and conspicuous danger signs shall be provided. The danger sign shall meet the requirements in 110.21(B)and shall read as follows:

DANGER — HIGH VOLTAGE — KEEP OUT

110.41 Inspections and Tests

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.