

Hospital Inspector Recertification Program

Part 3 2019 Electrical Code



2019 California Electrical Code



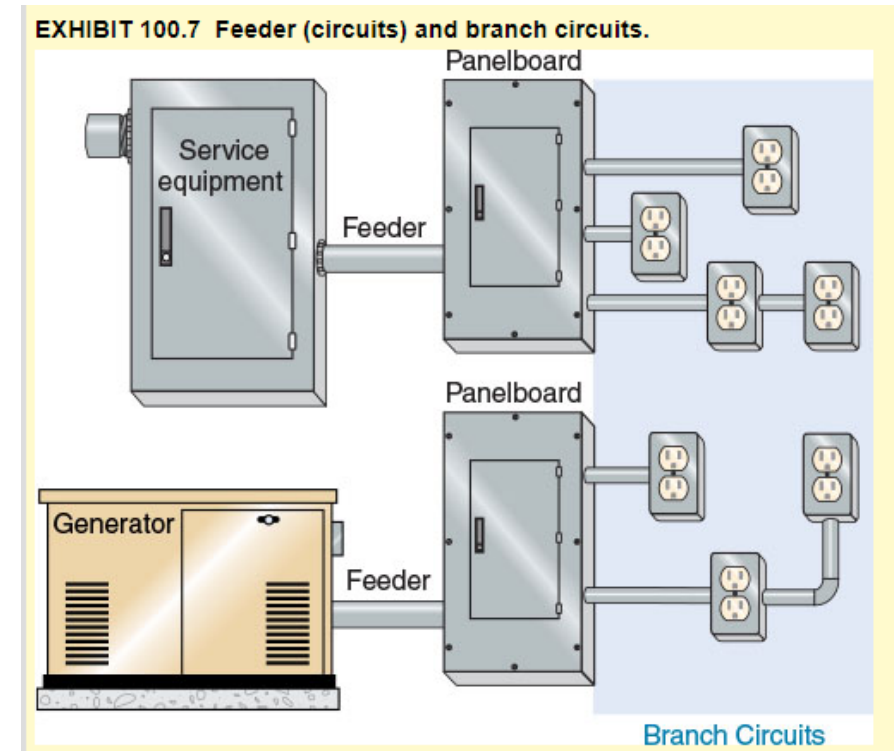
Includes:

- 2017 NEC
- 2019 California Amendments

Article 100

Electrical Conductors Definitions

- **Service Conductors**
 - The conductors from the service point to the service disconnecting means
- **Feeders**
 - All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device
- **Branch Circuits**
 - The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s)



- **Grounded Conductor**

- A system or circuit conductor that is intentionally grounded
- **This is NOT the equipment grounding conductor**
- Sometimes called the Neutral Conductor
- Insulation color usually white or gray (See CEC 200.6)

- **Equipment Grounding Conductor**

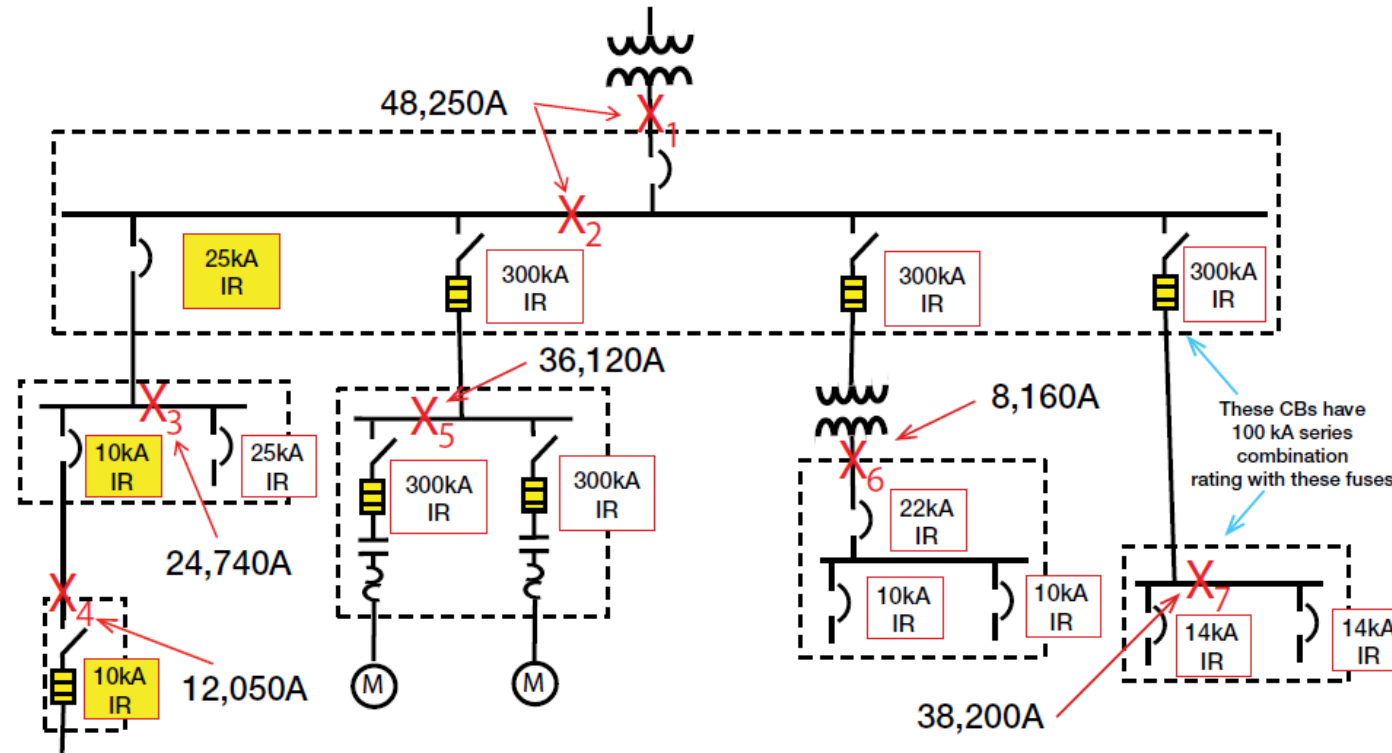
- The conductive path(s) that provides a ground-fault current path and connects normally non-current-carrying metal parts of equipment together and to the system grounded conductor or to the grounding electrode conductor, or both
- See CEC 250.118 for type of equipment grounding conductors
- Conductors can be bare, covered, or insulated
- Covering or insulation is green or green with yellow stripe, or otherwise identify per CEC 250.119

- Equipment intended to interrupt current at fault levels shall have an interrupting rating at nominal circuit voltage at least equal to the current that is available at the line terminals of the equipment.

FDE Interrupting Capacity RMS Sym. Ampere		
Volt	kA	NEMA Ratings
240 ~	65	
480 ~	35	
600 ~	18	
~ = 50/60 Hz		

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Which circuit breakers or fuses have an inadequate interrupting rating?

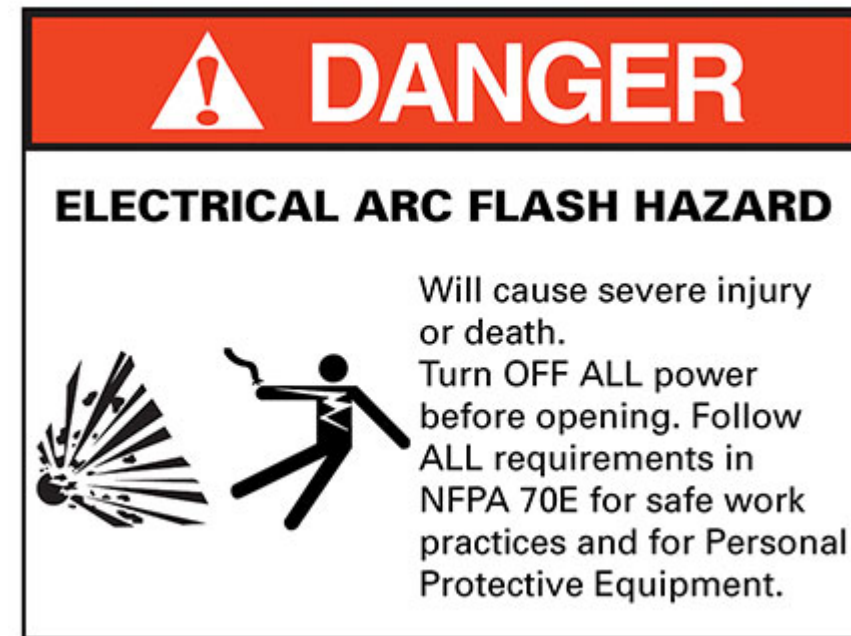
Article 110.14(D)

Electrical Equipment - Calibrated Torque

- 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.

Article 110.16(A) Arc-Flash Hazard Warning - General


- Electrical equipment, such as switchboards, switchgear, panelboards, industrial control panels, meter socket enclosures, and motor control centers shall be field or factory marked to warn qualified persons of potential electric arc flash hazards.



Article 110.16(B)

Arc-Flash Hazard Warning Service Equipment

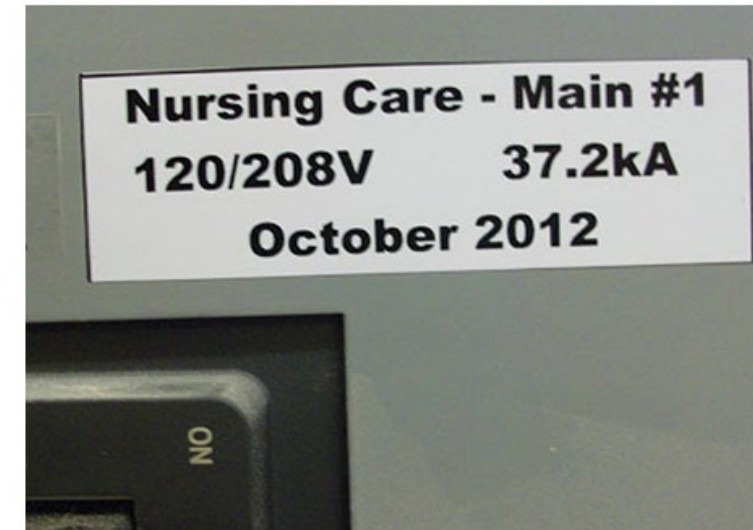
- A permanent label shall be field or factory applied to service equipment rated 1200 amps or more.
- Label shall contain the following information:
 - (1) Nominal system voltage
 - (2) Available fault current at the service overcurrent protective devices
 - (3) The clearing time of service overcurrent 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.
- Label must not be handwritten.
- Label shall be of sufficient durability to withstand the environment per 110.21(B)

 WARNING ARC FLASH HAZARD	
APPROPRIATE PPE REQUIRED	
NOMINAL SYSTEM VOLTAGE:	208/120 V
AVAILABLE FAULT CURRENT:	21,757 AMPERES
CLEARING TIME OF SERVICE OCPD:	0.03 Seconds (1.9 Cycles)
PSE TQS#: PQ LABORATORY Study Rev: 0 Date Issued: January 1, 2017	
LOCATION: MAIN SWBD PROTECTIVE DEVICE: MSB—POXFMR	

Article 110.24

Available Fault Current – Field Marking

- Electrical service equipment shall be legibly marked in the field with the maximum available fault current.
- The field marking 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, or operate the system.





Article 110.26(A)(1)-(3)

Working Space Requirements – 1000V or Less



- **Working Space**

- Required space for examination, adjustment, servicing, or maintenance electrical equipment while energized.

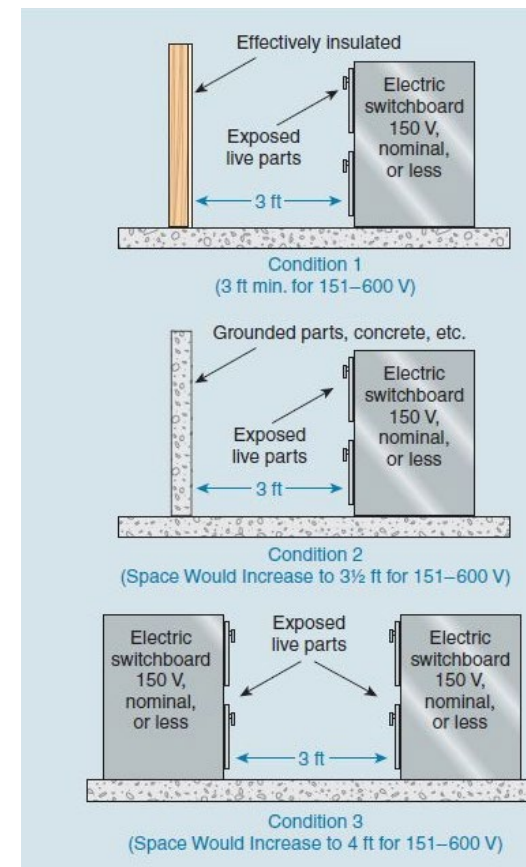
- **(1) Depth of Working Space.**

- The depth of the working space in the direction of live parts shall not be less than that specified in Table 110.26(A)(1). Distances shall be measured from the exposed live parts or from the enclosure or opening if the live parts are enclosed.
 - *Dead-Front Assemblies.* Working space shall not be required in the back or sides of assemblies, such as dead-front switchboards, switchgear, or motor control centers, where all connections and all renewable or adjustable parts, such as fuses or switches, are accessible from locations other than the back or sides. Where rear access is required to work on nonelectrical parts on the back of enclosed equipment, a minimum horizontal working space of 30 in. shall be provided.

Article 110.26(A)(1)-(3) Working Space Requirements – 1000V or Less

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)





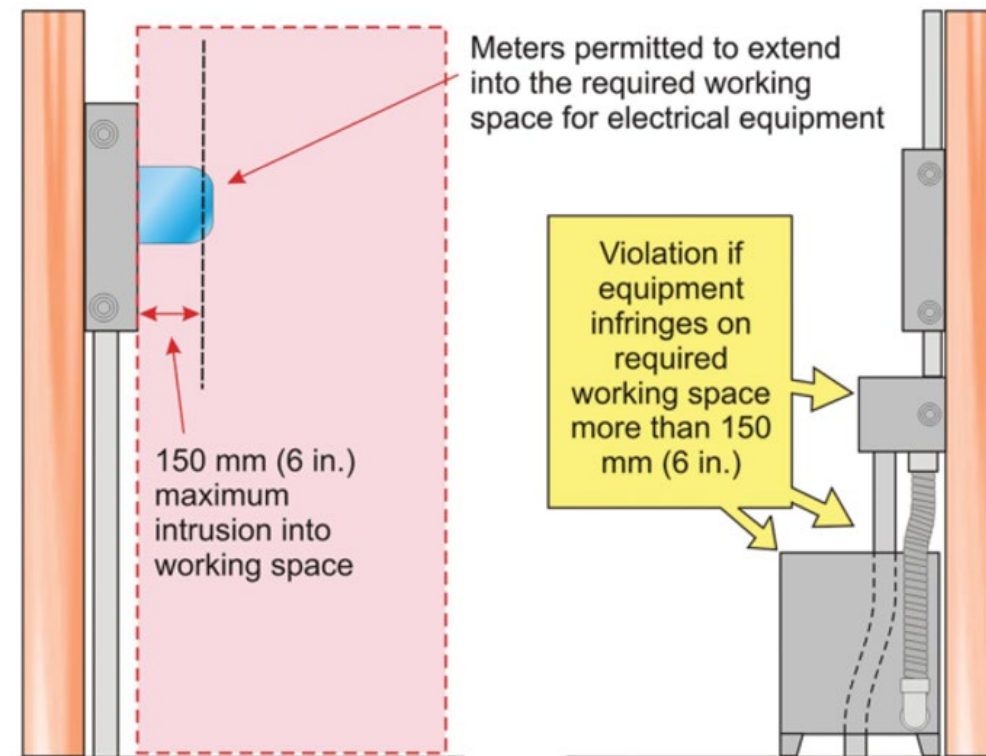
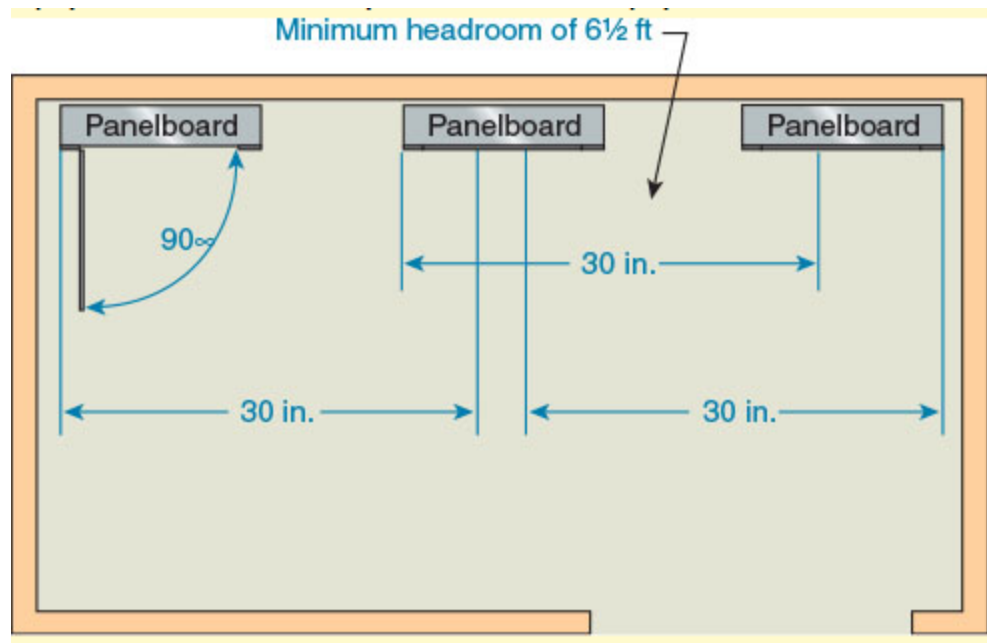
Article 110.26(A)(1)-(3) (Cont.)

Working Space Requirements – 1000V or Less



- **Width of Working Space.** The width of the working space in front of the electrical equipment shall be the width of the equipment or 30 in., whichever is greater. In all cases, the work space shall permit at least a 90 degree opening of equipment doors or hinged panels.
- **Height of Working Space.** The work space shall be clear and extend from the grade, floor, or platform to a height of 6 ½ ft or the height of the equipment, whichever is greater. Within the height requirements of this section, other equipment that is associated with the electrical installation and is located above or below the electrical equipment shall be permitted to extend not more than 6 in. beyond the front of the electrical equipment.

Article 110.26(A)(1)-(3) (Cont.) Working Space Requirements – 1000V or Less





Article 110.26(A)(4)

Limited Access Working Space Requirements



- Where equipment operating at 1000 volts or less to ground and likely to require examination, adjustment, servicing, or maintenance while energized is required by installation instructions or function to be located in a space with limited access, all of the following shall apply:
 - Where equipment is installed above a lay-in ceiling, there shall be an opening not smaller than 22 in. × 22 in., or in a crawl space, there shall be an accessible opening not smaller than 22 in. × 30 in
 - The width of the working space shall be the width of the equipment enclosure or a minimum of 30 in., whichever is greater
 - All enclosure doors or hinged panels shall be capable of opening a minimum of 90 degrees
 - 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
- This requirement was formerly located in 424.66. A typical application of this requirement is the installation of duct heaters and other ventilation equipment located above suspended ceilings. The workspace is usually limited and workers are usually performing maintenance from ladders

- **Clear Spaces**

- Working space required by this section shall not be used for storage. When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space, shall be suitably guarded.



Article 110.26(B) Clear Space Violations





Article 110.26(C)

Dedicated Equipment Space – 1000V or Less



- **Dedicated Equipment Space**

- All switchboards, switchgear, panelboards, and motor control centers shall be located in dedicated spaces and protected from damage

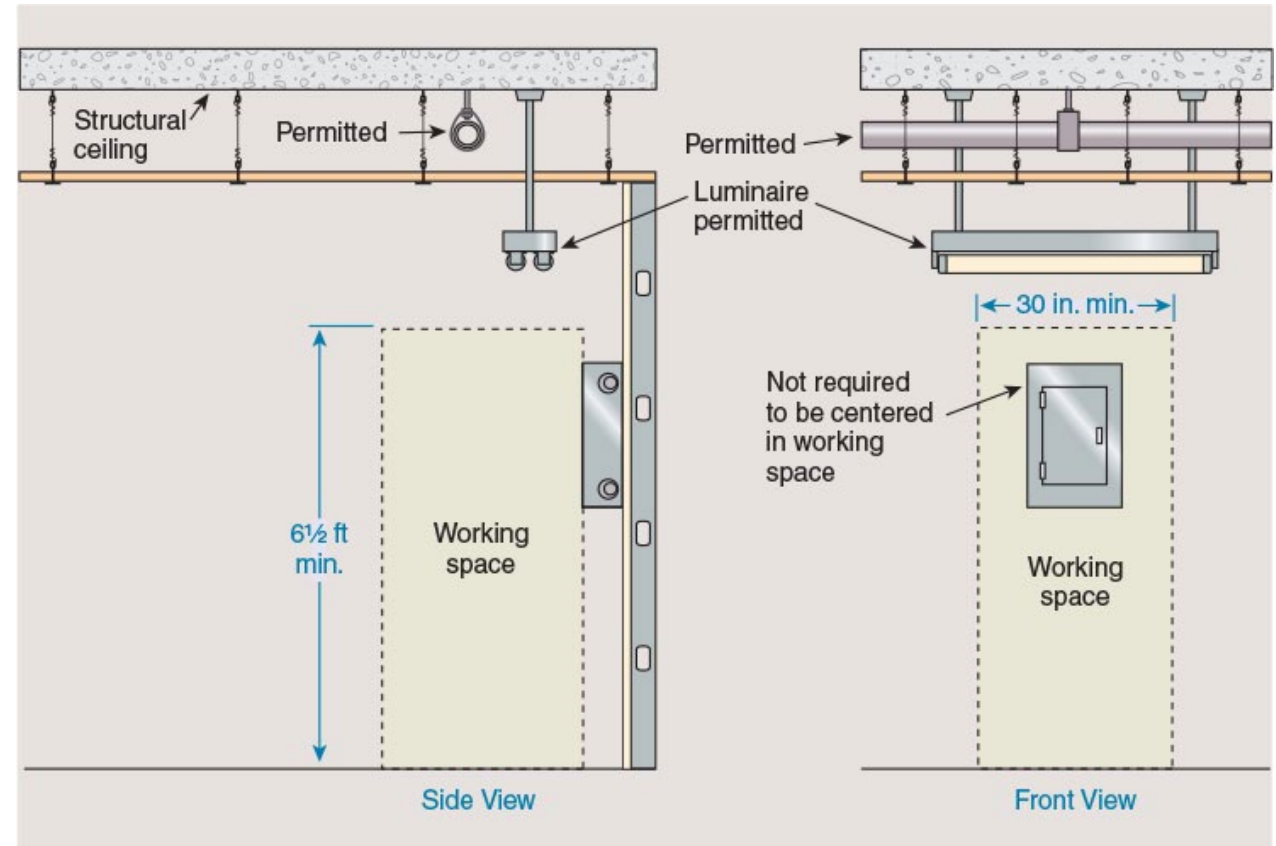
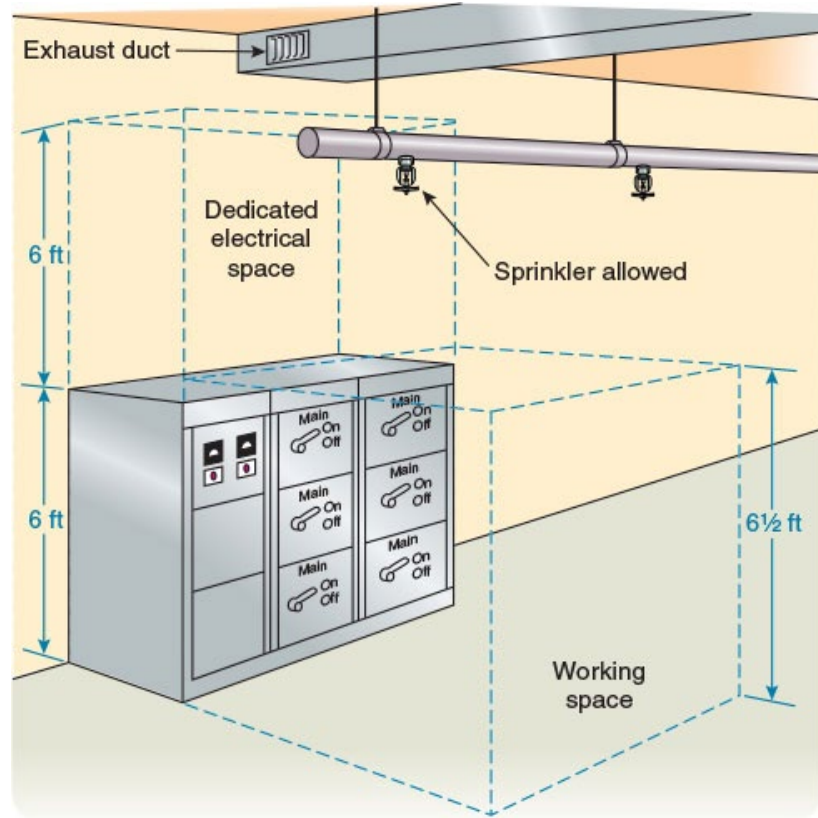


Article 110.26(C)

Indoor Dedicated Equipment Space – 1000V or Less

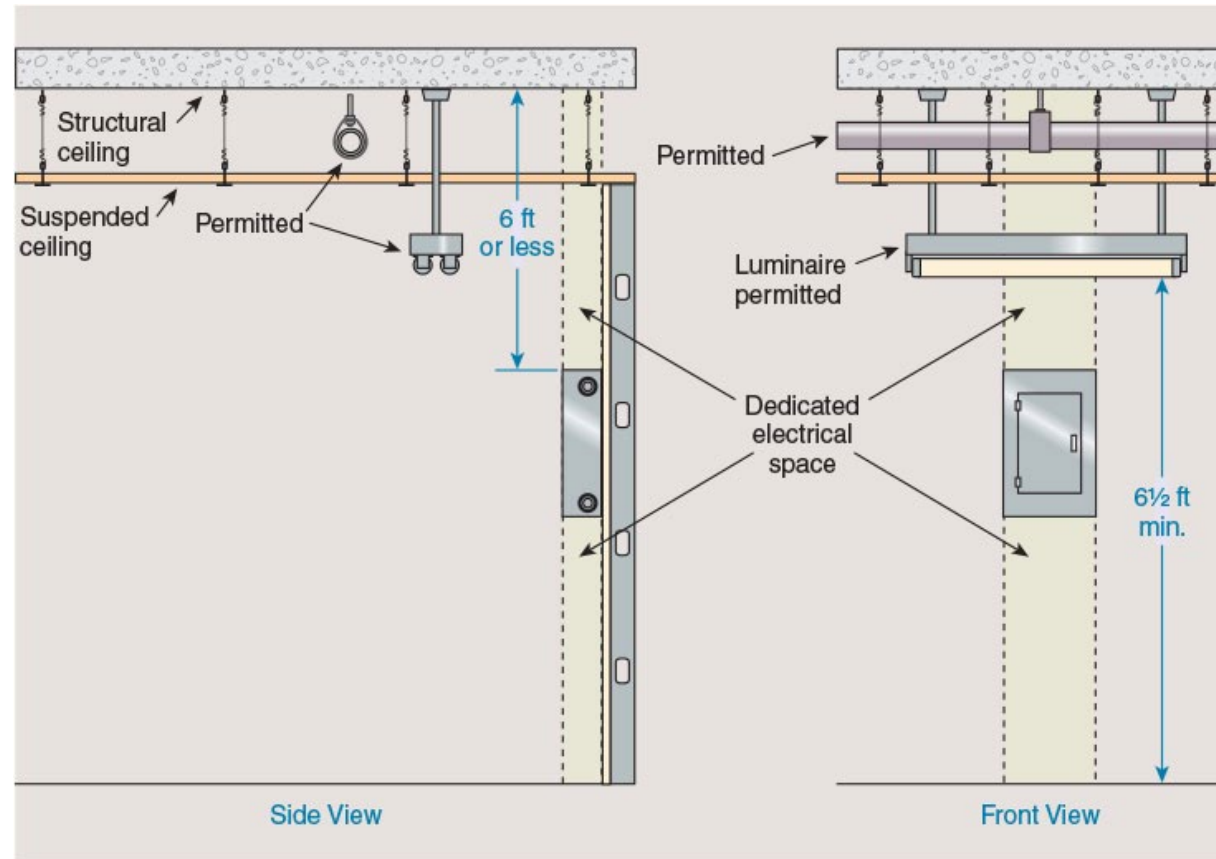
- The space equal to the width and depth of the equipment and extending from the floor to a height of 6 ft above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation
- No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone
 - Exception: Suspended ceilings with removable panels shall be permitted within the 6-ft zone
- *Foreign Systems.* The area above the dedicated space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks, or breaks in such foreign systems
- *Sprinkler Protection.* Sprinkler protection shall be permitted for the dedicated space where the piping complies with this section
- *Suspended Ceilings.* A dropped, suspended, or similar ceiling that does not add strength to the building structure shall not be considered a structural ceiling

Article 110.26(C) Indoor Dedicated Equipment Space – 1000V or Less



Article 110.26(C)

Indoor Dedicated Equipment Space – 1000V or Less





Article 110.26(C)

Outdoor Dedicated Equipment Space – 1000V or Less



- Outdoor electrical equipment shall be:
 - Installed in identified enclosures
 - Protected from accidental contact by unauthorized personnel or by vehicular traffic
 - Protected from accidental spillage or leakage from piping systems
- *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: Structural overhangs or roof extensions shall be permitted in this zone.
- *Dedicated Equipment Space*
 - The space equal to the width and depth of the equipment, and extending from grade to a height of 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

Article 210.8(B)

Locations Requiring GFCI Protection

- Bathrooms
- Kitchens
- Rooftops
- Outdoors
- Sinks
- Indoor wet locations
- Locker rooms with associated showering facilities
- Garages, service bays, and similar areas
- Crawl spaces — at or below grade level
- Unfinished portions or areas of the basement not intended as habitable rooms
- Exception: GFCI protection shall NOT be required for receptacles located in general care or critical care patient bed locations

Article 210.8(B)

Receptacles Requiring GFCI Protection

- For 210.8(B) locations, GFCI protection is required for:
 - All single-phase receptacles rated 150 volts to ground or less, 50 amperes or less
 - Three-phase receptacles rated 150 volts to ground or less, 100 amperes or less.
- 2016 CEC only required 125V, single phase, 15 and 20 ampere receptacles to be GFCI protected
- Protection provided by GFCI circuit breaker or GFCI receptacle





Article 210.64

Receptacle for Electrical Service Area



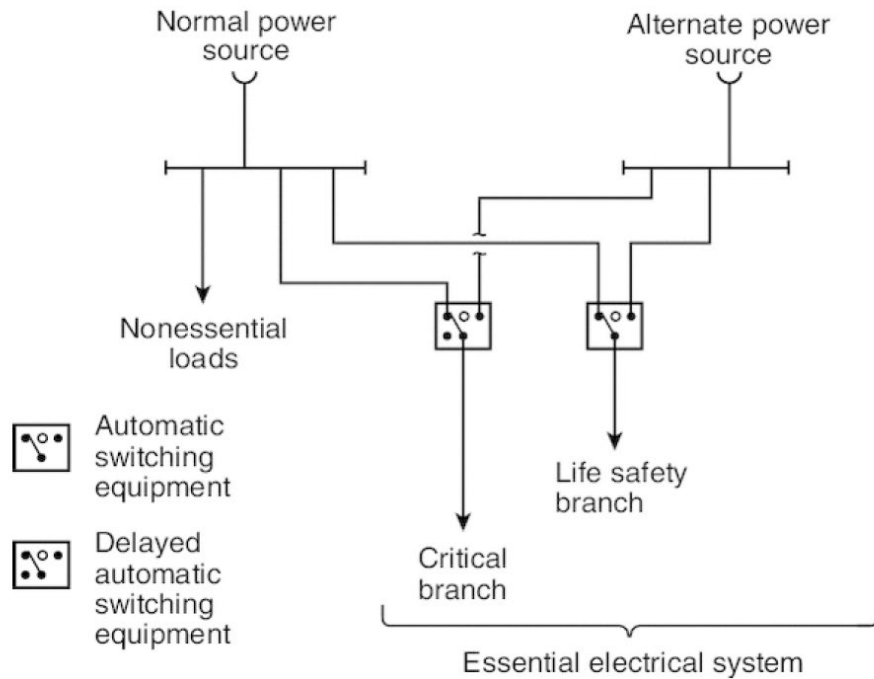
- Requires 125-volt single-phase, 15- or 20-ampere-rated receptacle installed in an accessible location within 25 ft of the indoor electrical service equipment
- Receptacle shall be located within the same room or area as the service equipment
- 2016 CEC allowed receptacle to be within 50 ft of electrical service equipment

Article 517

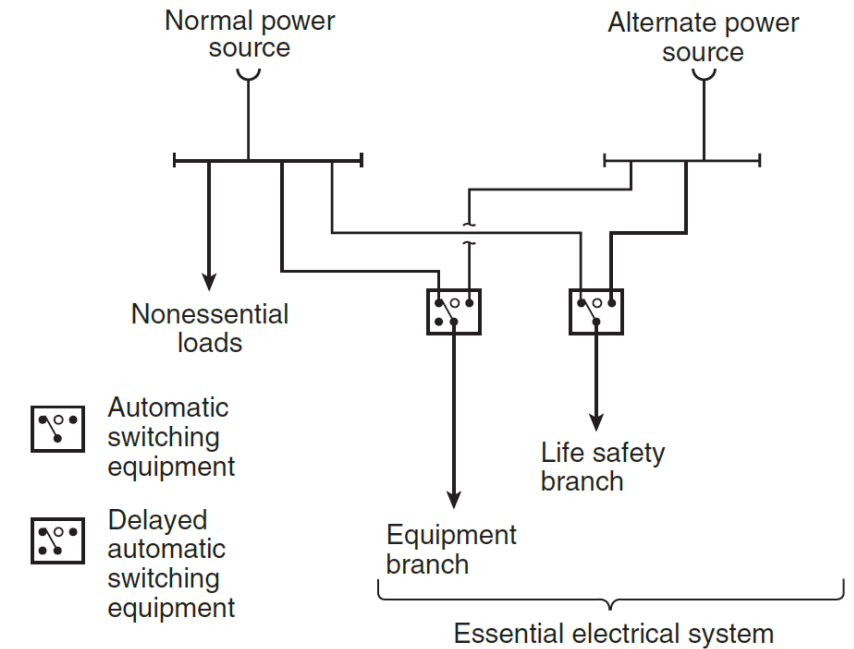
Health Care Facilities - General

- Reorganized hospital essential electrical system requirements found in 517.29 – 517.35.
- Reorganized intermediate and skilled nursing facilities essential electrical system requirements found in 517.40 – 517.44
- Change “critical branch” to “equipment branch” for skilled nursing and immediate care facilities essential electrical system requirements found in 517.42 & 517.44.

• 2016 CEC 517.42



• 2019 CEC 517.42

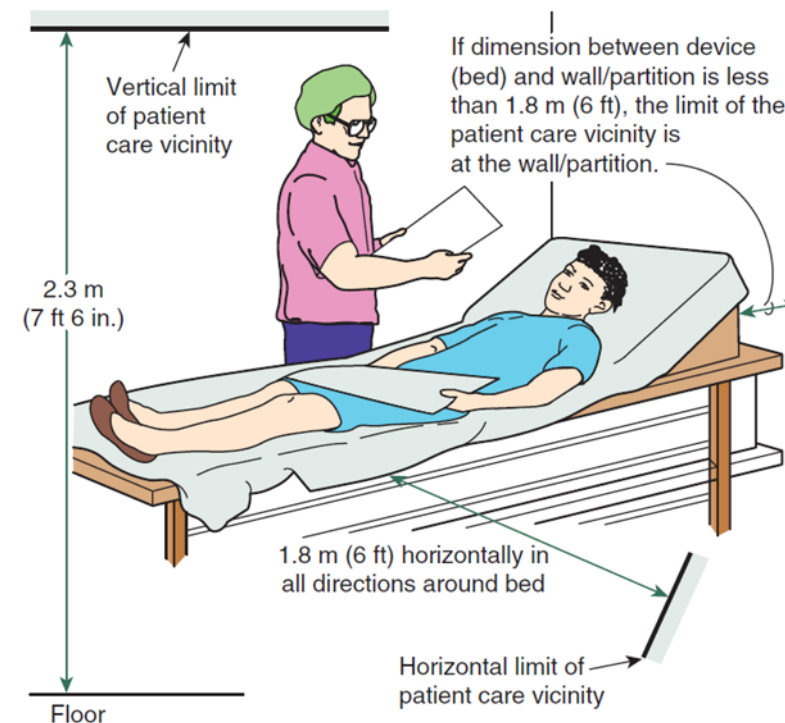


• Patient Care Space

- Any space of a health care facility wherein patients are intended to be examined or treated
- Support (Category 4) Space
- Basic Care (Category 3) Space
- General Care (Category 2) Space
- Critical Care (Category 1) Space

• Patient Care Vicinity

- A space, within a location intended for the examination and treatment of patients, extending 6 ft. beyond the normal location of the patient bed, chair, table, treadmill, or other device that supports the patient during examination and treatment and extending vertically to 7 ½ ft. above the floor





Article 517.13 - Grounding of Receptacles and Equipment in Patient Care Spaces



- 517.13(A)
 - Requires metal conduits or a cable having a metallic armor or sheath assembly for branch circuits serving patient care spaces.
 - Metal raceway system, metallic cable armor, or sheath assembly shall itself qualify as an equipment grounding conductor in accordance with 250.118
- 517.13(B)
 - Requires green insulated copper equipment grounding conductor installed with branch circuits
 - Connect equipment grounding conductor to receptacles grounding terminals (other than isolated ground receptacle), metal boxes, and fixed equipment likely to be energized.
- Exception No. 3: Luminaires more than 7 ½ ft. above the floor and switches located outside of the patient care vicinity shall be permitted to be connected to an equipment grounding return path complying with 517.13(A) **or (B)**.

Article 517.16

Use of Isolated Ground Receptacles

- **(A) Inside of a Patient Care Vicinity.** Isolated ground receptacles shall not be installed within a patient care vicinities
- **(B) Outside of a Patient Care Vicinity.** Isolated ground receptacles may be installed in patient care spaces outside of a patient care vicinities if:
 - Install green with one or more yellow stripes insulated isolated grounding conductor and connect to grounding terminals of isolated ground receptacles
 - Install green with no yellow stripes insulated equipment grounding conductor and connect to the boxes, enclosures, non-current-carrying conductive surfaces of fixed electrical equipment.





Article 517.18(B) Exception No. 3

Nursing Home Receptacles



- *Hospital grade receptacles shall not be required in patient sleeping areas in nursing homes.*

Article 517.31(C)(1)

Separation from Other Circuits

Essential electrical system for hospital and other facilities where patient are sustained by life-support

- Life safety branch kept entirely independent of all other wiring and equipment and shall not enter the same raceways, boxes, or cabinets or other wiring except as allowed in 517.31(C)(1)
- Critical branch shall be kept entirely independent of all other wiring and equipment and shall not enter the same raceways, boxes, or cabinets or other wiring except as allowed in 517.31(C)(1)
- Where patient care spaces are served from two separate transfer switches, the circuits from the two separate systems shall be kept independent of each other
- Equipment branch wiring shall be permitted to occupy the same raceways, boxes, or cabinets of normal branch circuits.

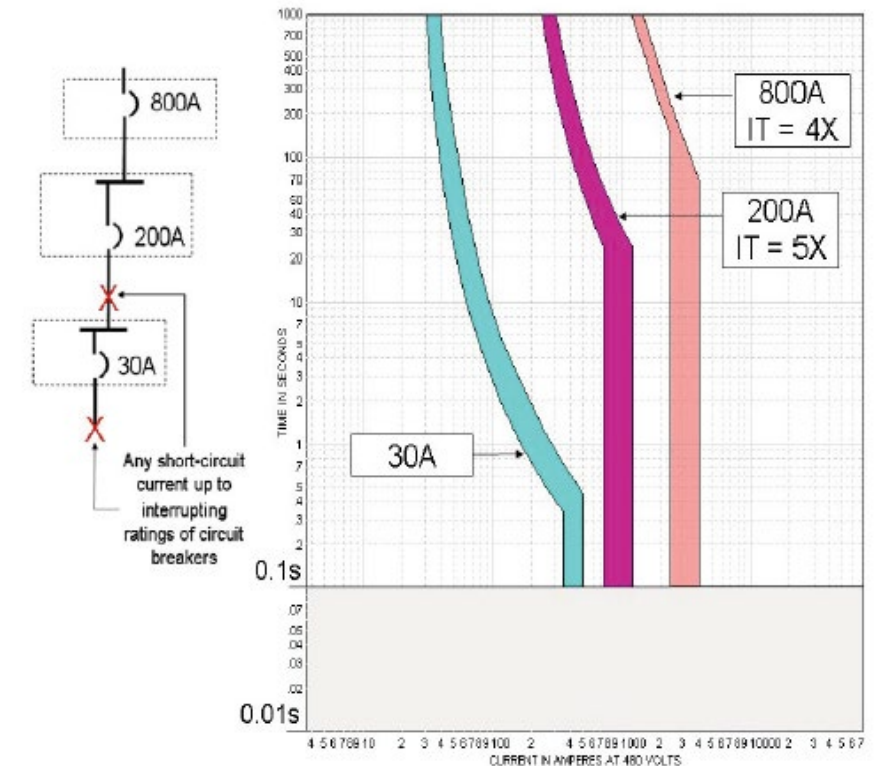


Article 517.31(C)(3) - Mechanical Protection of the Hospital Essential Electrical System



- Wiring of the life safety and critical branches shall be mechanically protected.
- Typically nonflexible metal raceways, Schedule 80 PVC conduit or Schedule 40 PVC conduit encased in 2 inches of concrete are used but other options are allowed
- PVC and other nonmetallic raceways shall not be used for branch circuits that supply patient care areas due to 517.13 requirements.
- Flexible metal raceways and listed metal sheathed cable assemblies can be used:
 - Where used in listed prefabricated medical headwalls
 - In listed office furnishings
 - Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage
 - Where necessary for flexible connection to equipment
 - **For equipment that requires a flexible connection due to movement, vibration, or operation**
 - **Luminaires installed in rigid ceiling structures where there is no access above the ceiling space after the luminaire is installed**
 - *Where necessary to allow relative movement between immediately adjacent buildings*

- Overcurrent protective devices serving the essential electrical system shall be coordinated for the period of time that a fault's duration extends beyond 0.1 second
- EEOR submits a coordination study with breaker settings for essential electrical system.



Intermediate and Skilled Nursing Facilities

- No longer requires illuminated face or an indicator light on receptacle
- Distinctive color or marking requirements remains unchanged

Article 517.44(A)

Nurse Call System Powered by Equipment Branch

Intermediate and Skilled Nursing Facilities

- Nurse call systems to be powered by Equipment Branch instead of Life Safety Branch
- Exception No. 2: Existing nurse call systems may remain on the life safety branch



Article 705.31

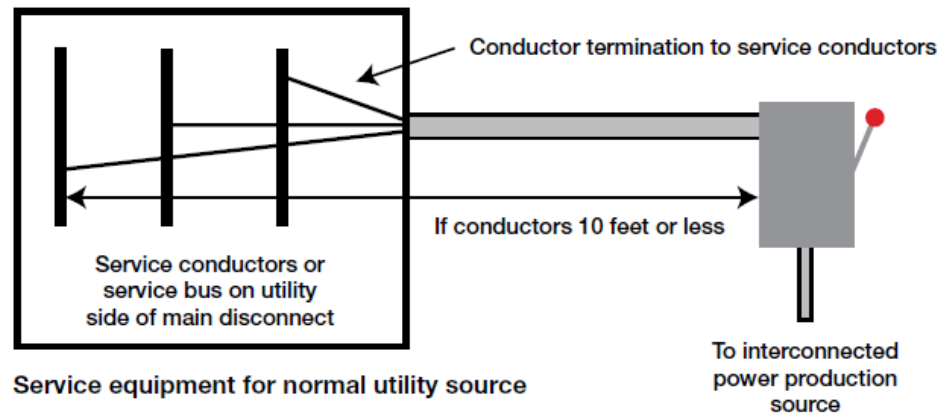


Supply Side Connected Electrical Power Production Sources

- Electric power production source such as a solar photovoltaic system shall be permitted to be connected to the supply side of the service disconnecting means per 705.12(A)
- Overcurrent protection for electric power production source conductors shall be located within 10 ft. of the point where the electric power production source conductors are connected to the service.
- Exception: If overcurrent protection for the electric power production conductors is not within 10 ft., cable limiters or current limiting circuit breaker shall be installed on each ungrounded conductor at the point where the conductors are connected to the service

Supply Side Connected Electrical Power Production Sources

- 10 feet or less



- Greater than 10 feet

