

Electrical Code Updates

Prepared for



Course # 36151
&
Course # 28067



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May 11, 2023

CODE CHECK

Acknowledgments



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Virginia Code Adoptions

Model Code	Year	Virginia Year
I-Codes	2018	Current
I-Codes	2021	2024
NEC	2017	Current
NEC	2020	2024

Delayed adoption has advantages & disadvantages

CODE CHECK

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Article 110 – Requirements for Electrical Installations

110.14(D) Electrical Connection Torque Tools



Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a calibrated torque tool is generally required to be used to achieve the indicated torque value.

Model Code Change

Revises previous change in 2019 Code

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Model Code Change

Article 110 – Requirements for Electrical Installations

110.14 Electrical Connections

110.14(D): Terminal Connection Torque

Changed to simply say that “an approved means” shall be used to achieve the indicated torque value. No longer references calibrated torque tool.

Re-torquing a termination can damage the connection if done at the same setting as the original torque. A re-test at 90% can meet the UL standard. Other means can be used, such as IR testing, breakaway bolts, other means in accordance with manufacturer instructions.

Use Annex I when markings not available.

Revises previous change in 2019 Code

CODE ☒ CHECK

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2017 NEC Text

110.14(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.

2020 NEC Text:

110.14(D) Terminal Connection Torque. Tightening torque values for terminal connections shall be as indicated on equipment or in installation instructions provided by the manufacturer. An approved means shall be used to achieve the indicated torque value.

Revises previous change in 2019 Code

CODE ☒ CHECK

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GFCIs?

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210.8 GFCIs

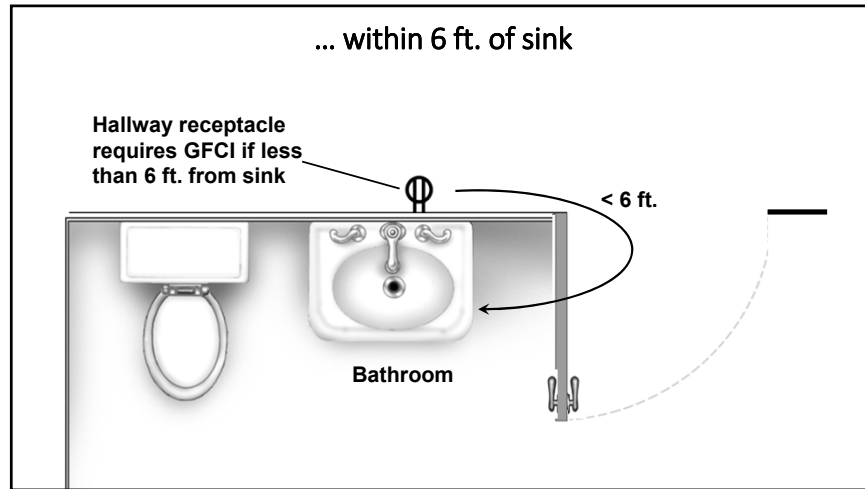
Model Code Change

- ☐ Measurement of distance from receptacles is the stretched-string (shortest path) distance without piercing a floor, wall, ceiling, fixed barrier, ~~door, doorway,~~ or window
- ☐ Door and doorway were removed from above list.
 - The intent was to clarify that a cabinet door, such as one under the kitchen sink, would not exempt a receptacle under that sink from the requirement for GFCI protection.

Revision

CODE ☒ CHECK

23



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210.8 GFCIs

Implications of change in measurement distance:

- ☐ Disposers and other under-sink receptacles require GFCI protection.
- ☐ A receptacle outside a bathroom may require GFCI protection if the distance between it and the sink is within 6 ft., even if the cord would have to pass through a doorway.

(The wording of the 2014 NEC implied that disposer receptacles required GFCI protection, whereas the 2017 NEC “clarified” that it did not require such protection. The 2020 NEC affirms that it does.)

CODE ~~W~~ CHECK

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210.8(A) Dwelling Unit GFCIs

- ☐ All 125-volt through 250-volt receptacles installed in the locations specified in 210.8(A)(1) through (A)11 and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit interrupter protection for personnel.

All dwelling units, whether supplied by a 120/208 system or a 120/240 system, have ungrounded conductors with a voltage to ground of less than 150 volts. What this change is saying is that 240-volt appliances, such as clothes dryers, ranges, and others, require GFCI protection in the locations specified by 210.8(A) 1 – 11.

CODE ~~W~~ CHECK

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210.8(A)(5) Basements

- ☐ Receptacles in basements require GFCI protection.
- ☐ The only exception is a receptacle supplying a permanently installed fire alarm or burglar alarm system.

Because a basement is below grade there is a possibility of moisture in the floor slab and it is being treated the same as any other damp or wet location for purposes of GFCI protection.

CODE ~~W~~ CHECK

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Model Code Change

210.8(A)(11) Wet Areas in Dwelling Units

- ❑ Receptacles in indoor damp and wet locations

An example could be a “mud room” or similar area.

NEW

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Model Code Change

210.8(E) Equipment Requiring Servicing

NEW

CODE CHECK

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Model Code Change

210.8(F) Outdoor Outlets for Dwellings

- ❑ All outdoor outlets for dwellings (other than the exception for de-icing equipment) require GFCI protection. This includes outlets for air conditioning equipment.

Note that this new rule is for outlets, not necessarily receptacle outlets. In most air conditioning circuits, the local disconnecting means is the outlet.

A temporary interim amendment (TIA 1589) was approved by the NFPA Standards Council. It adds a second exception for listed HVAC equipment, with the exception expiring on September 1, 2026. The state of California and the City of Oakland have not adopted this TIA.

NEW

CODE CHECK

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Model Code Change

210.8(B) Other than Dwelling Unit GFCIs

- ❑ All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts or less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the locations specified in 210.8(B)(1) through (B)(12) shall have ground-fault circuit interrupter protection for personnel.

The change here is for single-phase 250-volt receptacles.

3-phase GFCI units are available and required for several common types of commercial kitchen equipment.

Revision

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GFCIs in Other than Dwelling Units

210.8(B)(6) Indoor damp and wet locations

210.8(B)(8) Garages, accessory buildings, service bays...

210.8(B)(11) Laundry areas

210.8(B)(11) Bathtubs and shower stalls – where receptacles installed within 6 ft of the outside edge of the bathtub or shower stall

Model Code Change

Revision

CODE CHECK

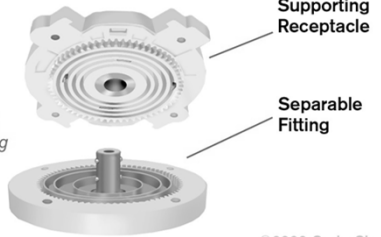
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Exception for Listed Locking Support and Mounting Receptacles

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Separable Attachment Fittings

Listed locking support & mounting receptacles for luminaires or ceiling fans allow for ready interchange with compatible equipment.



Supporting Receptacle

Separable Fitting

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2017 Model Code Change

Not a Change

CODE CHECK

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210.8(D) Other than Dwelling Unit GFCIs

422.5(A) Appliances rated 150 volts to ground and 60 amperes or less single- or three-phase require GFCI protection.

(2) Drinking water coolers and bottle fill stations

(6) Sump pumps

(7) Dishwashers

(Dishwashers relocated from 210.8(D) to 422.5(A)(7). This rule previously only applied to dwelling units and now includes commercial)

Model Code Change

New

CODE CHECK

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Non-Dwelling Receptacle GFCI Requirements **20 NEC**

Applies to all receptacles rated 125 – 250V

<input type="checkbox"/> Bathrooms	210.8B1
<input type="checkbox"/> Kitchens or areas with a sink & permanent provisions for either food preparation or cooking	210.8B2 ⁵⁵
<input type="checkbox"/> Rooftops & outdoors EXC	210.8B3&4
• Circuit dedicated to non-readily accessible receptacles for snow-melting or deicing equipment w/ GFPE	
<input type="checkbox"/> Sinks – where receptacles within 6 ft. from top inside edge of bowl	210.8B4
<input type="checkbox"/> Indoor damp & wet locations	210.8B5
<input type="checkbox"/> Locker rooms w/ associated showering facilities	210.8B6 ⁵⁶
<input type="checkbox"/> Garages, accessory building, service bays & similar areas other than vehicle exhibition halls and showrooms	210.8B7
<input type="checkbox"/> Crawl spaces at or below grade level	210.8B8
<input type="checkbox"/> Unfinished areas of basements	210.8B9
<input type="checkbox"/> Laundry areas	210.8B10
<input type="checkbox"/> Within 6 ft. of outside edge of bathtubs & shower stalls	210.8B11 ⁵⁶
<input type="checkbox"/> Listed locking support & mounting receptacles F33 for ceiling luminaires & fans do not req GFCI protection except in indoor damp & wet locations, locker rooms, crawl spaces, laundry areas & within 6 ft. of tub/shower	210.8B12 ⁵⁶
	210.8BX ⁵⁷

Model Code Change

Revision

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Model Code Change	Non-Dwelling Appliance GFCI Requirements	
	<i>The requirements below apply to all appliances rated ≤150V to ground, ≤60A, single phase or 3-phase. Multiple Class A devices permitted.</i>	
	<input type="checkbox"/> Automotive vacuum machines _____	422.5A1
	<input type="checkbox"/> Drinking water coolers & bottle fill stations _____	422.5A2
	<input type="checkbox"/> Cord/plug connected high pressure spray wash machines _____	422.5A3
	<input type="checkbox"/> Tire inflation machines _____	422.5A4
	<input type="checkbox"/> Vending machines _____	422.5A5
	<input type="checkbox"/> Sump pumps _____	422.5A6
	<input type="checkbox"/> Dishwashers _____	422.5A7
	<input type="checkbox"/> Automotive vacuum machines _____	422.5A1
CODE W CHECK		

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Model Code Change

What's Next?

- ❑ The 2023 NEC re-organizes 210.8 and includes other requirements now located in Article 422. Greater consistency of terms. All receptacles in kitchens will require GFCI
- ❑ The following will require GFCI protection regardless of occupancy or location:
 - Electric ranges
 - Wall-mounted ovens
 - Counter-mounted cooking units
 - Clothes dryers
 - Microwave ovens

CODE ~~W~~ CHECK

Next Cycle

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Local Code Amendment

210.11(C)(1) Small-Appliance Branch Circuits

NEC: In addition to the number of branch circuits required by other parts of this section, two or more 20-ampere small appliance branch circuits shall be provided for all receptacle outlets specified by 210.52(B).

City of Oakland Amendment adds the following sentence:

“Each appliance fastened in place, including but not limited to dishwashers, garbage disposals, trash compactors, microwave ovens, shall be supplied by a separate branch circuit rated for the appliance or load served.”

CODE ~~W~~ CHECK

Same as Previous Code Cycle

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Model Code Change

210.11(C)3 Bathroom Branch Circuits

"In addition to the number of branch circuits required by other parts of this section, one or more 120-volt 20-ampere branch circuit(s) shall be provided to supply bathroom receptacles outlet(s) required by 210.52(D) and any countertop and similar work surface outlets. Such circuits shall have no other outlets." (Exception when the circuit supplies a single bathroom it can supply other equipment in that bathroom).

The previous code required that the 20-amp circuit supply ALL receptacle outlets in the bathroom. This new language allows for additional receptacle outlets in addition to those required by 210.52(D) and allows those additional receptacle outlets to be on 15-amp circuits.

Revision

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Model Code Change

406.9(C) Bathtub and Shower Space

Receptacles are not allowed in the zone shown below. In bathrooms with less than the required zone, the receptacle is permitted opposite the tub rim or shower stall on the farthest wall within the room.

NEW

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Model Code Change

2023 NEC

- ☐ Adds the space below the zone shown in the figure.
- ☐ Allows receptacle for electric toilet (personal hygiene device) but not in the space between the toilet and the bath/shower.

Revision

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Model Code Change

Garage Branch Circuits

210.11(C)4 At least one 120-volt 20-amp circuit to supply receptacle outlets required by 210.52(G)(1) for garages... The circuit shall have no other outlets (Exception: The circuit shall be permitted to supply readily accessible outdoor outlets.)

210.52(G): At least one receptacle shall be installed in each vehicle bay and not more than 5 ½ ft. above the floor. (Exception: Garage spaces not attached to an individual dwelling unit of a multifamily dwelling shall not require a receptacle outlet in each vehicle bay.)

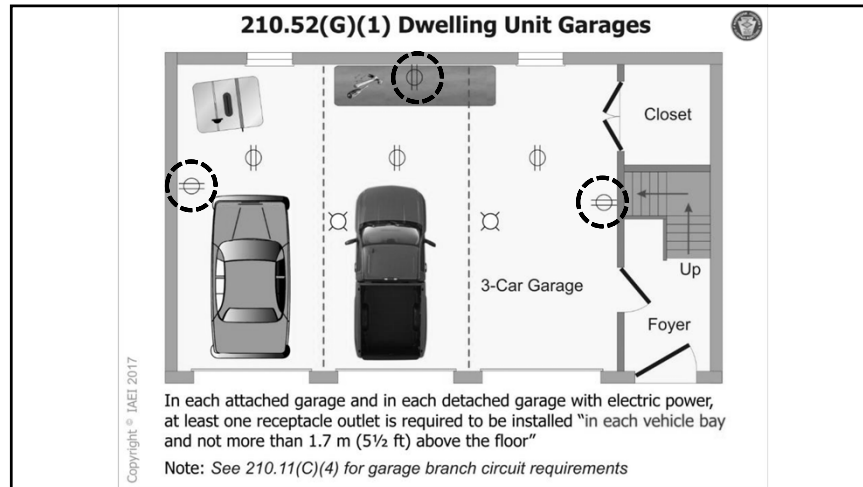
The previous code cycle required the receptacle not more than 5 ½ ft. above the floor in each vehicle bay, and allowed one circuit to supply all the outlets in the garage. The new code does not allow this 20-amp circuit to also supply the lights or the vehicle door operator.

Is a tandem garage one vehicle bay or two?

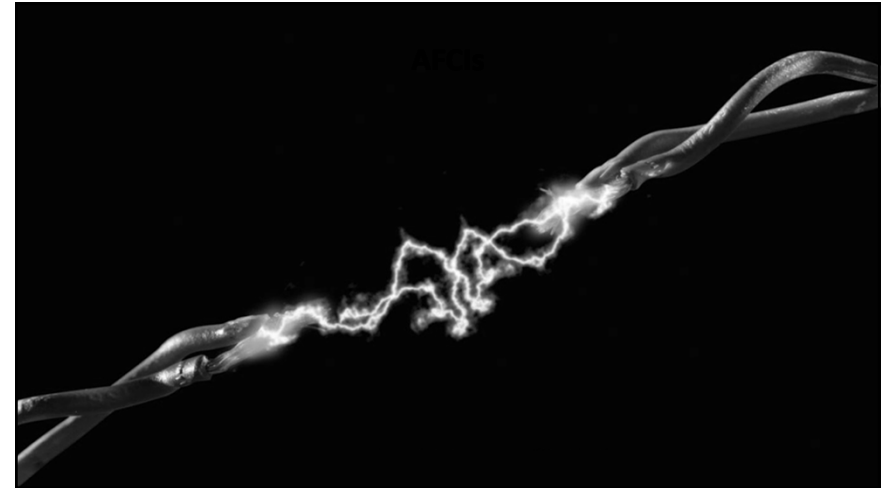
Revision

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AFCIs – Extensions of Existing Branch Circuits

210.12 Exception: AFCI protection shall not be required where the extension of the existing branch circuit conductors is not more than 6 ft. and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Panel, circuit breaker, or service replacement does not trigger a requirement for AFCI protection, and the old service can be used as a junction box to extend its circuits to an adjacent service panel.

CODE ☒ CHECK

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Areas Requiring AFCI Protection

210.12(C) Added guest suites, patient sleeping rooms in nursing homes and limited-care facilities.

210.12(D) for branch circuit extensions, added dormitory units and guest rooms and guest suites.

CODE ☒ CHECK

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Model Code Change

AFCIs — Replacements & Extensions in Areas Where AFCI Protection Currently Required

Existing receptacle
Replace with OBC AFCI at first outlet of branch circuit being extended

Unprotected home run

AFCI-protected extension

New box & Receptacle on extended circuit

Replacement of existing ungrounded receptacle
Replace with OBC AFCI or dual-function GFCI & OBC AFCI with labels as directed in packaging instructions

Either (1) AFCI at origin of branch circuit, or (2) ordinary breaker + metal conduit or tubing or MC or steel AC cable & OBC AFCI in new box

New box & receptacle

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Expanded Scope

CODE CHECK

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AFCIs

Outlet Branch Circuit AFCIs

Receptacle Type

Blank Face

AFCIs

CODE CHECK

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AFCIs

Dual-Function AFCI-GFCI

AFCIs

CODE CHECK

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AFCIs

New Siemens with Plug-On Neutral

Dual Function AFCI/GFCI

No pigtailed neutrals

—

Branch Circuit neutral connects to breaker.

Combination AFCI only (no GFCI)

No pigtailed neutrals

—

Branch circuit neutral connects to neutral bus

GFCI only breaker

No pigtailed neutrals

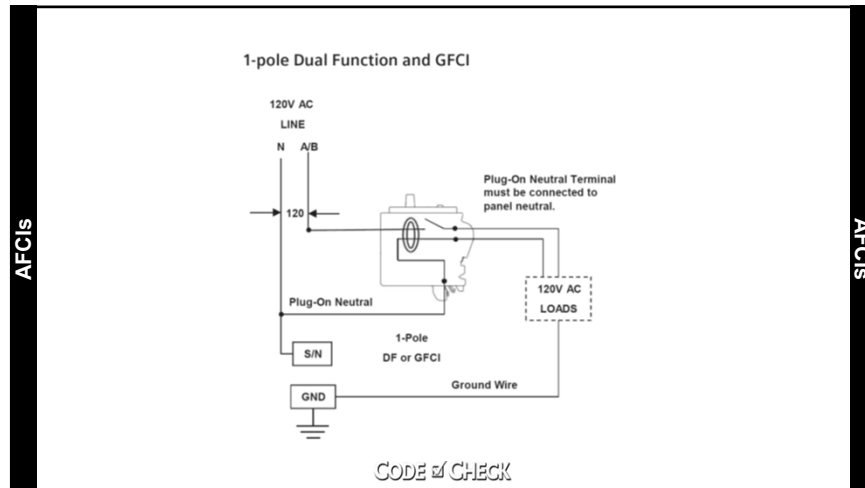
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Branch Circuit neutral connects to breaker.

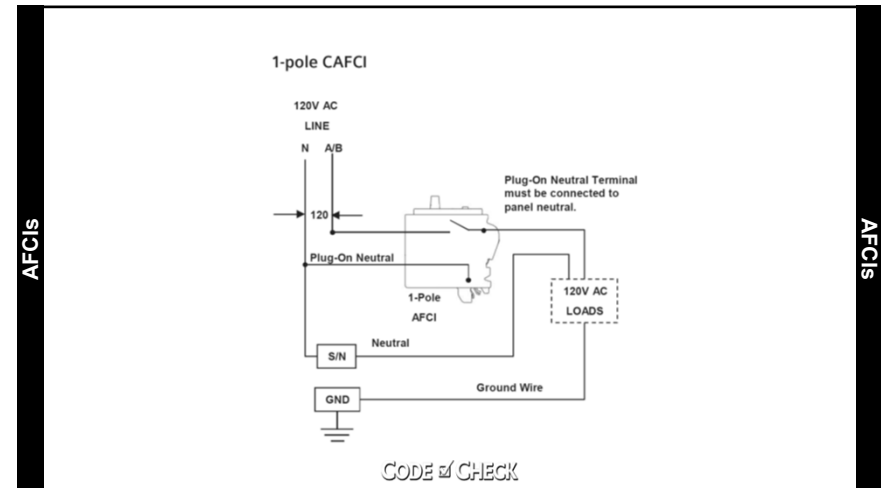
AFCIs

CODE CHECK

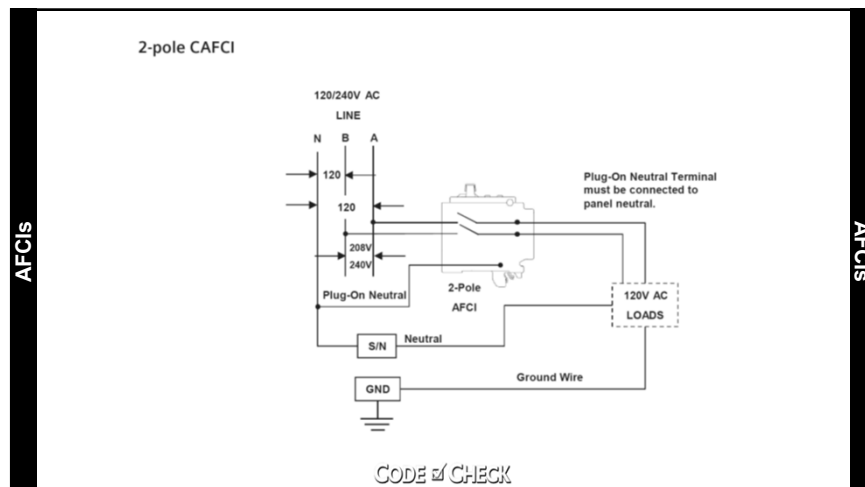
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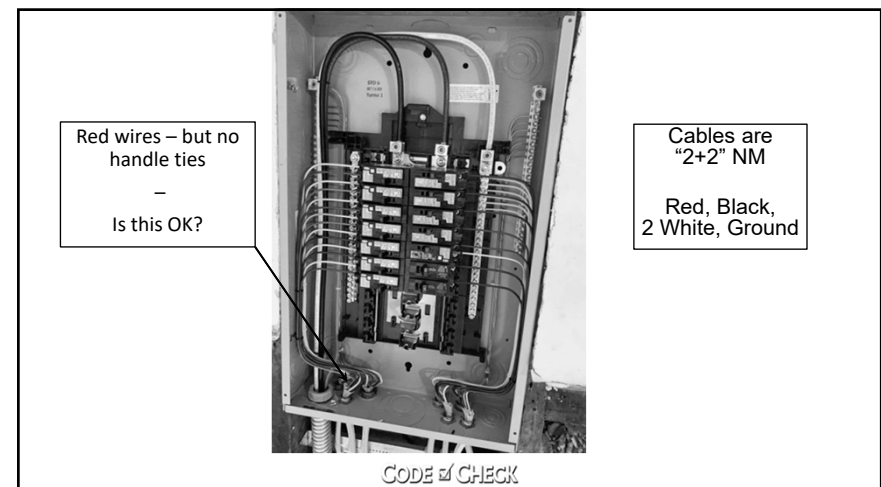
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210.52(C) Countertops and Work Surfaces

210.52(C)2 Islands and Peninsular Countertops and Work Surfaces

- No longer has a definition of what constitutes a separate countertop space
- Requires at least one receptacle outlet within 2 ft of the outer end of a peninsular countertop or work surface.
- Requires one for the first 18 ft² of space and receptacle outlets for each additional 9 ft² of space.
- These additional required receptacle outlets permitted to be located as determined by the installer, designer, or building owner.

A peninsular countertop shall be measured from the connected perpendicular wall (same as previous cycle).

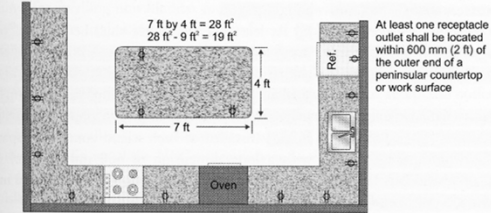
CODE ~~W~~ CHECK

60

2020 NEC

210.52(C)(2) Island and Peninsulars

At least one receptacle outlet shall be provided for the first 0.84 m² (9 ft²), or fraction thereof, of the countertop or work surface.
A receptacle outlet shall be provided for every additional 1.7 m² (18 ft²), or fraction thereof, of the countertop or work surface.

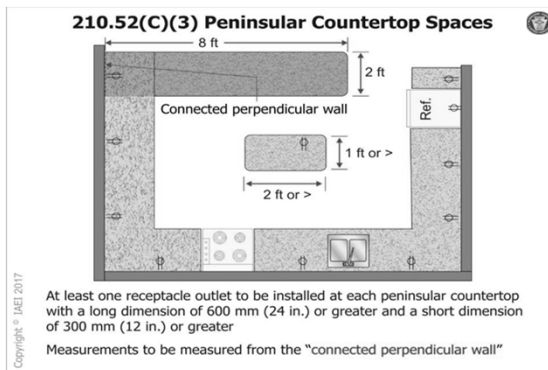


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2017 NEC

210.52(C)(3) Peninsular Countertop Spaces

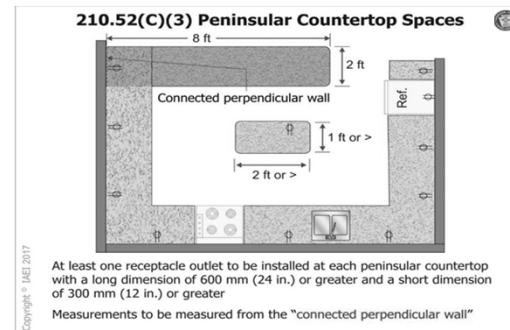


CODE ~~W~~ CHECK

62

A peninsular countertop shall be measured from the connected perpendicular wall

210.52(C)(3) Peninsular Countertop Spaces




CODE ~~W~~ CHECK

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Receptacle Locations

210.52(C)2

How do you measure from the "connected perpendicular wall" when the peninsular countertop is not perpendicular to the wall?



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Interpretation Problem

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Model Code Change

2022 CEC: 210.52(C)(3) Receptacle Outlet Location

1. On or above countertop or work surfaces
2. In countertop or work surfaces (listed pop-ups)
3. Below countertop or work surfaces (maximum 12 in. below and maximum overhang of 6 in.)

Previous code language restricted below-counter receptacles to islands and peninsulas that were flat across the top and to construction for the physically impaired. That language has been removed.

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Revision

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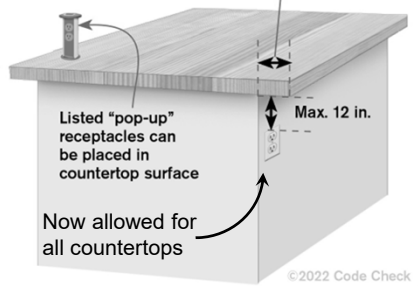
Model Code Change

Receptacle Locations

Code ☒ Check

Island and peninsular countertops require 1 receptacle for the first 9 sq. ft. & additional receptacles for each subsequent 18 sq. ft. or fraction thereof. Receptacles can be on the side of the cabinet no more than 12 in. from the countertop surface if the overhang of the countertop does not exceed 6 in.

Island Countertop



Listed "pop-up" receptacles can be placed in countertop surface

Now allowed for all countertops

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Expanded Scope

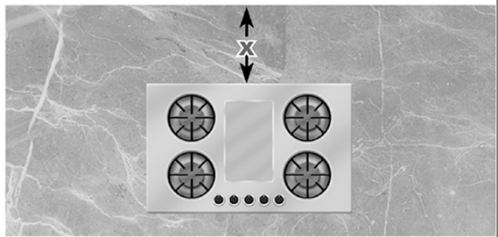
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Model Code Change

Old (2019 CEC) Determination on # of Spaces

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If **X** < 12 in., the countertops are considered separate spaces and each requires a receptacle



Island Range or Sink

©2017 Code Check

Sunsetted

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2023 NEC

- ❑ Receptacle outlets at islands and peninsulas are not required. If not provided, provisions must be installed for adding outlets at a later date.
- ❑ Receptacles below the countertop surface are prohibited.

Model Code Change

Revision next code cycle

What are the Issues?

1. An insufficient number of receptacles will cause users to resort to extension cords, with the possibility of them being frayed, snagged, immersed, overheated, or otherwise damaged.
2. Receptacles below the countertop create a hazard of being accidentally snagged or (more importantly) of a child reaching up and grabbing the cord, thereby pulling the appliance on top of them.

Model Code Change

Revision

CODE ✓ CHECK

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Island Countertops

Receptacle Locations

Not a Change

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Receptacle Locations

Not a Change

*CODE ✓ CHECK*

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Model Code Change

Receptacles in Islands & Peninsulas

2019 CEC	2022 CEC	2025 CEC
One per "countertop space"	One for 1 st 18 ft ² One for each additional 9 ft ²	Optional
Locate above, listed surface assembly, or up to 12 in. below	Locate above, listed surface assembly, or up to 12 in. below	Locate above, or use listed surface assembly

Revisions

The Consumer Product Safety Commission has compiled reports of this issue contributing to 9,700 burns or other injuries treated in hospital emergency rooms since 1991. Children might pull on the cords, and adults might get snagged when walking by. A wheelchair-bound individual died from hot contents being pulled onto them.

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Model Code Change

Receptacles in Islands & Peninsulas

Essential viewing: Ryan Jackson video on kitchen islands and peninsulas in the 2023 NEC:

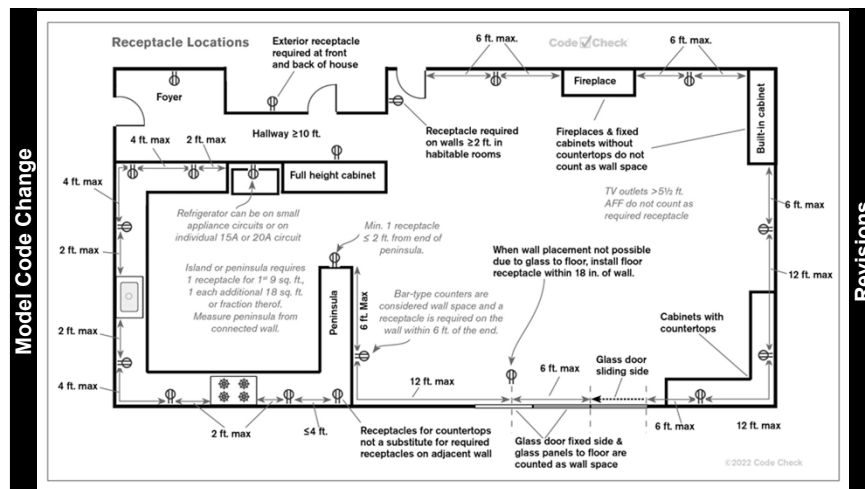
<https://www.youtube.com/watch?v=CFwoCkINlow>



Revisions

CODE CHECK

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Model Code Change

210.52(E)(3)

Balconies, decks, and porches that are within 4 in. horizontally of the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck, or porch.



Extends the rule to include freestanding adjacent decks, etc.

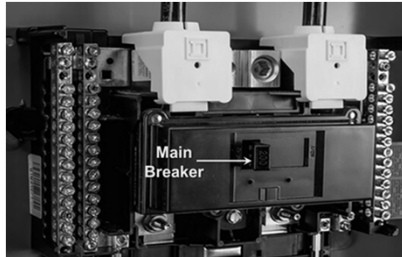
Revision

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Model Code Change

230.62(C) – Barriers in Service Equipment

☐ Barriers shall be placed in service equipment such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.



CODE CHECK

NEW

83

Model Code Change

230.62(C) – Barriers in Service Equipment

☐ In the previous code cycle, this section was located in 408.3(A)(2) and it had an exception for service panels with provisions for more than one service disconnect within a single enclosure, as was then allowed 408.36 exceptions 1, 2 & 3. Those exceptions are no longer allowed, as all services now require a single disconnect per service enclosure.

☐ This rule is consistent with changes made in 2018 to UL 67.

☐ The concept here is that once the service breaker or switch is opened, there can be no exposed energized components within the equipment.

NEW

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84

Model Code Change

230.62(C) – Barriers in Multifamily Service Equipment

☐ No barrier between main disconnects

☐ Not allowed without a separate upstream service disconnect



CODE CHECK

NEW

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230.62(C) – Barriers in Commercial Equipment

Model Code Change

NEW

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230.71 – Maximum Number of Disconnects

- A. General. Each service shall have only one disconnecting means unless the requirements of 230.71(B) are met.
- B. Two to six service disconnecting means shall be permitted for each service permitted by 230.2 or for each set of service entrance conductors permitted by 230.40, Exceptions 1, 3, 4, or 5. The two to six service disconnecting means shall be permitted to consist of a combination of any of the following:
1. Separate enclosures with a main service disconnect in each enclosure.
 2. Panelboards with a main service disconnecting means in each enclosure.
 3. Switchboards where there is only one service disconnect in each separate vertical section where there are barriers separating each vertical section.
 4. Service disconnects in switchgear or metering centers where each disconnect is located in a separate compartment.

Model Code Change

Revision

CODE ~~W~~ CHECK

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230.85 – Emergency Disconnects

Model Code Change

New

CODE ~~W~~ CHECK

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230.85 – Emergency Disconnects

For one- and two-family dwelling units, all service conductors shall terminate in disconnecting means having a short-circuit current rating equal to or greater than the available fault current, installed in a readily accessible outdoor location. If more than one disconnect is provided, they shall be grouped.

Model Code Change

New

CODE ~~W~~ CHECK

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Model Code Change

230.85 – Emergency Disconnects

Each disconnect shall be one of the following:

1. Service disconnect marked as
EMERGENCY DISCONNECT
SERVICE DISCONNECT
2. Meter disconnects per 230.82(3) marked as
EMERGENCY DISCONNECT
METER DISCONNECT
NOT SERVICE EQUIPMENT
3. Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment and marked as
EMERGENCY DISCONNECT
NOT SERVICE EQUIPMENT

New

CODE ~~W~~ CHECK

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Model Code Change

230.85 – Emergency Disconnects

NEC Handbook Commentary:

This section recognizes the need for an outdoor disconnect for first responders. Until now, first responders and utility personnel have not had a way to safely remove power from a structure. This new requirement mandates that a means to disconnect the electric utility be located in a readily accessible, outdoor location. Mounting the emergency disconnect in a readily accessible location does not preclude locking the disconnect in the “on” position.

New

CODE ~~W~~ CHECK

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Model Code Change

230.85 – Emergency Disconnects

Related sections:

- 445.18(D) Generators
- 480.7(A) Storage Batteries
- 690.12(C) Photovoltaic Rapid Shutdown
- 694.22(C)(1) Wind Electric Systems
- 706.15(A) Energy Storage Systems

New

CODE ~~W~~ CHECK

94

Model Code Change

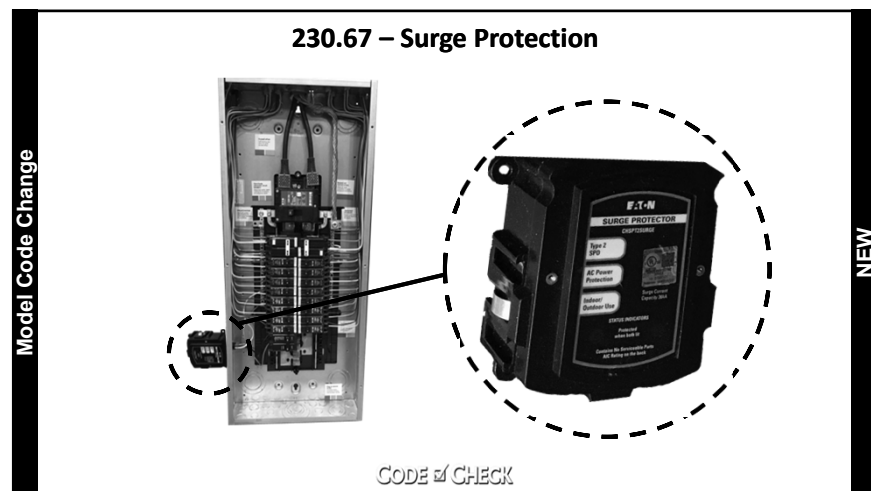
230.67 – Surge Protection

- A. Surge-Protective Device.** All services supplying dwelling units shall be provided with a surge-protective device (SPD).
- B. Location.** The SPD shall be an integral part of the service equipment or shall be located immediately adjacent thereto.
Exception: The SPD shall not be required to be located in the service equipment as required in (B) if located at each next level distribution equipment downstream toward the load.
- C. Type.** The SPD shall be a Type 1 or a Type 2 SPD.
- D. Replacement.** Where service equipment is replaced, all of the requirements of this section shall apply.

NEW

CODE ~~W~~ CHECK

95



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Types of Surge Protective Devices

- ☐ Type 1 – at supply or load side of service disconnect
- ☐ Type 2 – on load side of service or building disconnect
- ☐ Type 3 – on load side of branch circuit breaker
- ☐ Type 4 – built into equipment & installed by manufacturer
- ☐ Code requires type 1 or 2 at dwelling service, others can also be present.
- ☐ Mandatory upon a service upgrade 230.67(D)

Model Code Change

NEW

CODE & CHECK

97

Article 242 – Overvoltage Protection

- ☐ There are two basic approaches to overvoltage: Surge arresters protect against >1,000 volts. Surge- protective devices < 1,000 volts.
- ☐ Previous articles for surge arresters (article 280) and surge protective devices (article 285) were deleted in the 2020 NEC. New article 242 was added and titled “overvoltage protection”

Model Code Change

NEW

CODE & CHECK

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Article 242 – Overvoltage Protection

242.8 Listing. SPDs must be listed

242.10 Short Circuit Rating. The SPD shall be marked with a short-circuit current rating and shall not be installed at a point on the system where the available fault current is in excess of that rating. The marking requirement shall not apply to receptacles.

242.24 Routing of Connections. The conductors used to connect the SPF to the line or bus and to ground shall not be any longer than necessary and shall avoid unnecessary bends.

Model Code Change

NEW

CODE & CHECK

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Model Code Change

Concrete Encased Electrodes (Ufer)

250.53(C) Bonding Jumper of Grounding Electrode System:
Concrete encased electrodes shall not be used to interconnect the electrodes of grounding electrode systems. [Also stated in 250.68(C)(3)(c)]

250.68(C) Grounding Electrode Conductor Connections:
Connection can be made at an accessible location that is not subject to corrosion. The extension shall be continuous with the grounding electrode rebar or connected to the rebar with the usual steel tie wires, exothermic welding, or other means. The rebar cannot be exposed to contact with earth without corrosion protection.

CODE ~~W~~ CHECK

Revision

103

Model Code Change

Concrete Encased Electrodes (Ufer)

CODE ~~W~~ CHECK

Revision

104

Model Code Change

Equipment Grounding

250.109 Metal Enclosures:
Metal enclosures can be used to connect bonding jumpers or equipment grounding conductors. Also see section 200.2(B) – Metal enclosures CANNOT be used to interconnect grounded (neutral) conductors

CODE ~~W~~ CHECK

Revision

106

Model Code Change

Equipment Grounding

CODE ~~W~~ CHECK

Clarification

107

Article 300 – General Requirements for Wiring Methods

300.4 Protection Against Physical Damage:

(G) Fittings. Where raceways contain insulated 4 AWG conductors or larger, and these conductors enter a cabinet, a box, an enclosure, or a raceway, the conductors shall be protected by


- (1) An identified fitting providing a smoothly rounded insulating surface.
- (2) A listed metal fitting that has smoothly rounded edges.
- (3) Separation from the fitting or raceway using an identified insulating material that is securely fastened in place
- (4) Threaded hubs or bosses that are an integral part of a cabinet, box, enclosure, or raceway providing a smoothly rounded or flared entry for conductors.

CODE ☒ CHECK

109

Article 300 – General Requirements for Wiring Methods

(1) A listed metal fitting that has smoothly rounded edges.

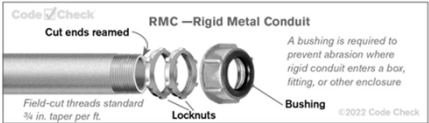


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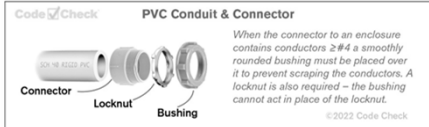
110

300.4(G) Protection Against Physical Damage

Also see 344.46 Bushings:



And 352.46:




CODE ☒ CHECK

111

300.7(A) Raceways Exposed to Different Temperatures

Sealants must be identified for use with cable or conductor insulation.



CODE ☒ CHECK

112

Article 310 – Conductors for General Wiring

- ❑ Extensive re-numbering and re-arrangement
- ❑ Table 310.16 is back!
- ❑ Table 310.12 (Dwelling Services) is back!
- ❑ New Article 311 for medium voltage conductors/cables

CODE ☒ CHECK

114

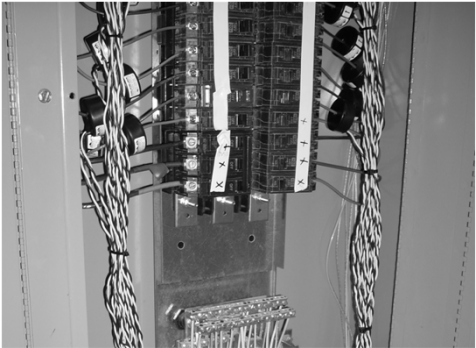
312.8(B) Power Monitoring or Energy Management Equipment

1. Identified as field-installable accessory of listed equipment.
2. Total area of conductors, splices, taps, & equipment at any cross-sectional space max 75% of space.
3. Conductors to comply with 725.49. Small conductors:
 - Enclosed within raceways & secured max 10 in. intervals
 - Secured within 10 in. of terminations
 - Secured to prevent contact with current-carrying components
 - Rated for system voltage and minimum 600 volts
 - Have minimum insulation rating of 90°C

CODE ☒ CHECK

115

312.8(B) Power Monitoring Devices



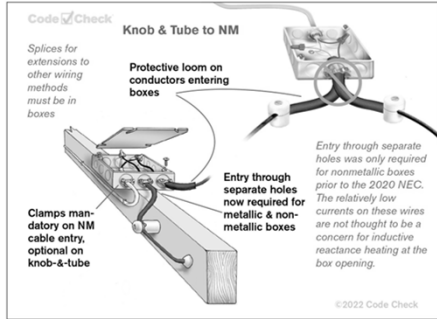
CODE ☒ CHECK

116

Article 314 – Boxes

314.17(B)(1) Conductors from Knob & Tube

Conductors to enter boxes through separate holes, including metal boxes (previously only applied to plastic boxes)



CODE ☒ CHECK

117

Model Code Change

314.16(B) Box Fill Calculations

A ¼ volume allowance now to be added for each additional equipment grounding conductor in excess of four.

Item	Size	#	Total
#14 conductors exiting box	2.00		
#12 conductors exiting box	2.25		
#10 conductors exiting box	2.50		
#8 conductors exiting box	3.00		
#6 conductors exiting box	5.00		
Up to 4 EGCs—count only largest one		1	
Each EGC >4 – count ¼ of largest in box for each			
Devices—2 ½ times the conductor size			
Internal clamps—one based on largest wire present		1	
Fixture fittings—one for each type based on largest wire			
TOTAL			

CODE CHECK

Revision

118

Model Code Change

314.27(C) Boxes at Ceiling Suspended Paddle Fan Outlets

Outlet boxes mounted in the ceilings of habitable rooms of dwelling occupancies in a location acceptable for the installation of a ceiling-suspended paddle fan shall comply with one of the following:

1. Listed for the sole support of ceiling-suspended paddle fans
2. An outlet box complying with the applicable requirements of 314.27 and providing access to structural framing capable of supporting a ceiling-suspended fan bracket or equivalent.

Previous code only required these if there were separately switched conductors installed.

CODE CHECK

Revision

119

Model Code Change

Securing NM Cable

334.30 In addition to the requirement that the cable be secured within 12 inches of the entry into enclosures such as outlet boxes, junction boxes, cabinets, or fittings, the length between the cable entry and the cable support is now limited to 18 inches.

CODE CHECK

Revision

120

Local Amendments Removed

Unamended NM Cable Protection in Attics

Code Check Cables in Attics

Not allowed on face of framing or spanning across joists within 6 ft. of access opening

Setback 1 ¼ in. from rafter face

Bored holes min. 2 in. from surface

1 × 2 guard strips protect cable

Guard Cable Guard

Cross section

Cable bend too sharp

CODE CHECK

No longer changes model code

122

Unamended NM Cable Protection Under Floors

Local Amendments Removed

Code ☒ Check

Cables Under Floor in Basement or Crawl Space

Through bored holes or on running boards if <8/3

OK secured to underside of joists if 6/2 or ≥8/3 cable

©2022 Code Check

No longer changes model code

CODE ☒ CHECK

123

Article 342 – Intermediate Metal Conduit

Model Code Change

342.10 Permitted where subject to severe physical damage.

342.14 Avoid use of dissimilar metals in direct contact. Stainless steel IMC is only to be used with stainless steel fittings, stainless steel boxes and enclosures, steel boxes when not subject to severe corrosive influences, and stainless steel or nonmetallic accessories.

Revision

CODE ☒ CHECK

124

Aluminum Wire

- ☐ Copper-Clad aluminum wire is back
- ☐ NM cable codes to match the white/yellow/orange for Cu wire
- ☐ Compatibility with terminals rated Cu

CODE ☒ CHECK

125

Aluminum Wire 2023 NEC

- ☐ 14 gauge Cu-clad aluminum wire
- ☐ 10-amp circuits and circuit breakers for lighting

CODE ☒ CHECK

126

394.12 Concealed Knob-&-Tube Wiring in Insulation

- ☐ Concealed knob-and-tube wiring shall not be used ...
5. in the hollow spaces of walls, ceilings, and attics where such spaces are insulated by loose, rolled, or foamed-in-place insulating material that envelops the conductors.

CODE ☒ CHECK

129

394.12 Concealed Knob-&-Tube Wiring in Insulation

- ☐ *Exception [HCD 1] This article is not intended to prohibit the installation of insulation where knob-and-tube wiring is present, provided the following are complied with:*
1. *The wiring shall be surveyed by an electrical contractor licensed by the state of California. Certification shall be provided by the electrical contractor that the existing wiring is in good condition with no evidence of deterioration or improper overcurrent protection, and no improper connections or splices. Repairs, alterations, or extensions to the electrical system will require permits and inspections by the authority having jurisdiction for the enforcement of this code.*

CODE ☒ CHECK

130



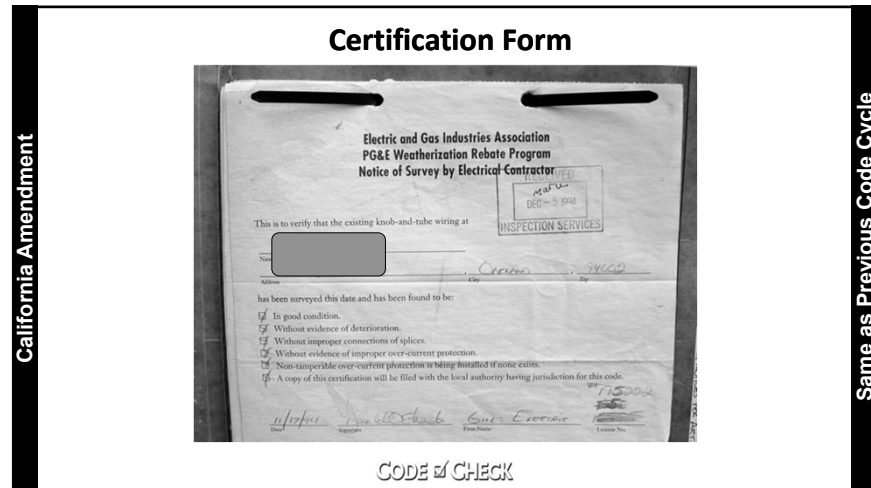
131

394.12 Concealed Knob-&-Tube Wiring in Insulation

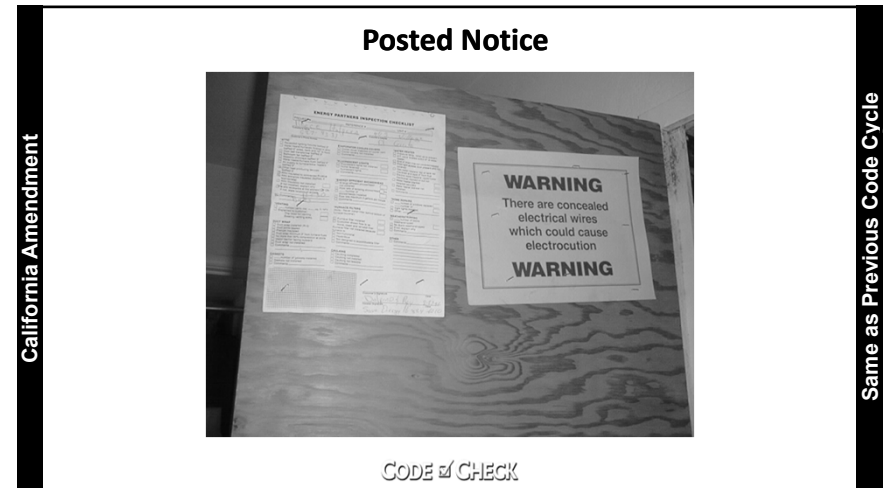
2. *The certification form shall be filed with the authority having jurisdiction for the enforcement of this code, and a copy furnished to the property owner.*
3. *All accessible areas in the building where insulation has been installed around knob-and-tube wiring shall be posted by the insulation contractor with a notice, clearly visible, stating that caution is required when entering those areas. The notice shall be printed in both English and Spanish.*
4. *The insulation shall be noncombustible.*
5. *The insulation shall be non-conductive.*
6. *The AHJ may permits and inspections for installing insulation.*

CODE ☒ CHECK

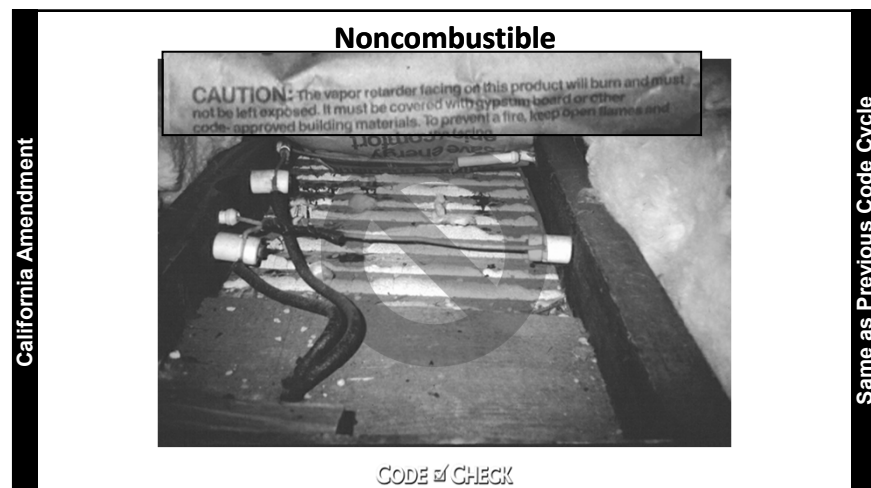
132



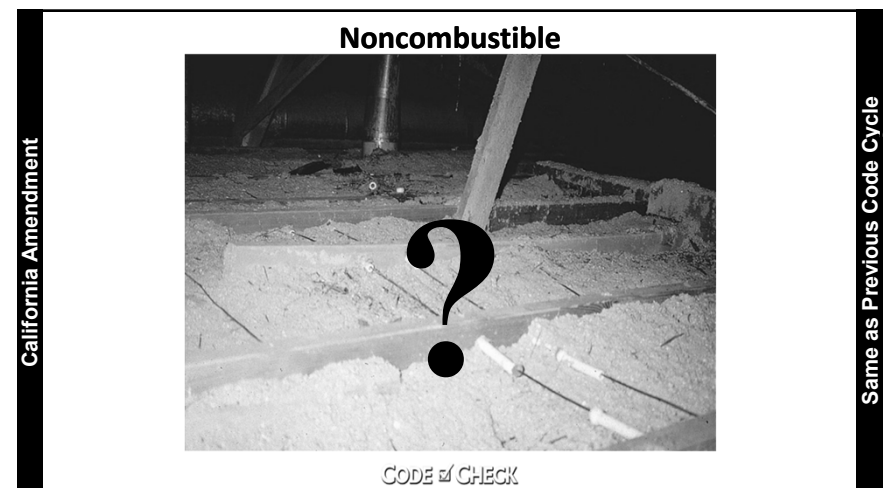
133



134




135



136

California Amendment

Nonconductive



CODE ☒ CHECK


Same as Previous Code Cycle

137

Model Code Change

406.5(G)(2) Receptacle Outlets under Sinks

☐ Receptacles shall not be installed in a face-up position in the area below a sink.



CODE ☒ CHECK

New

144

Model Code Change

406.12 Tamper Resistant Receptacles

Tamper Resistant (TR) Receptacles – Required Locations

<input type="checkbox"/> All dwelling unit receptacles specified in 210.52 EXC _____	4002.14	406.12
• Receptacles located >5½ ft. above floor _____	4002.14X1	406.12X1
• Receptacles are part of a luminaire or appliance _____	4002.14X2	406.12X2
• Receptacles in space of appliance that is not readily moved (such as clothes washer) _____	4002.14X3	406.12X3
<input type="checkbox"/> Guest rooms & suites of hotels, motels & their common areas, pre-schools, education facilities, business offices, & waiting rooms in clinics _____	n/a	406.12
<input type="checkbox"/> Attached or detached garages, accessory buildings, common areas of MFDs, dormitory units & assisted living facilities _____	n/a	406.12 ⁶⁰

CODE ☒ CHECK

New

145

California Amendment

408.2 Panelboards in Dwelling Units

408.2(A) In single-family residential buildings that include one or two dwellings, panelboards serving the individual dwelling unit shall be provided with circuit breaker spaces for heat pump water heaters, heat pump space heaters, electric cooktops and electric clothes dryers as specified in California Energy Code section 150.0(n), (t), (u), and (v).

408.2(B) In multifamily buildings, panelboards serving the individual dwelling unit shall be provided with circuit breaker spaces for heat pump space heaters, electric cooktops and electric clothes dryers as specified in California Energy Code section 160.9(a), (b), and (c).

CODE ☒ CHECK

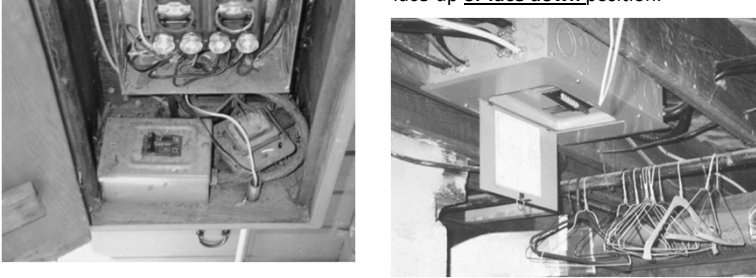
New

146

Article 408 – Switchgear, Switchboards, & Panelboards

408.43 Panelboard Orientation.
Panelboards shall not be installed in the face-up position.

2023 NEC:
408.43 Panelboard Orientation.
Panelboards shall not be installed in the face-up or face down position.



Model Code Change

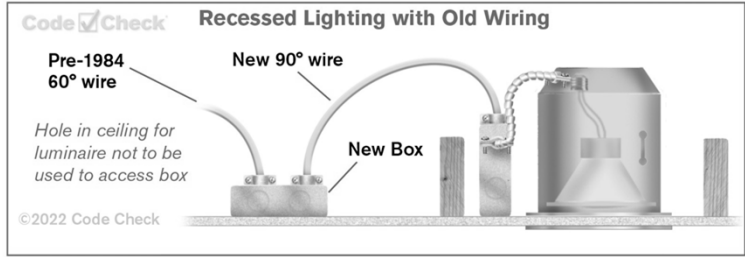
CODE ☒ CHECK

New

156

410.118 Recessed Ceiling Luminaires

Recessed ceiling luminaires shall not be used to access outlet, pull, or junction boxes or conduit bodies, unless the box or conduit body is an integral part of the listed luminaire.



Model Code Change

CODE ☒ CHECK

New

158

Article 410 – Part XVI – Horticultural Lighting

- ☐ Required to be listed
- ☐ Required to comply with 500 – 517 in hazardous locations
- ☐ Check with local fire department
- ☐ The 2023 NEC has an article on Cannabis Extraction & Processing
- ☐ ANSI/CAN/UL/ULC provides listing for such equipment
- ☐ Licensing required by the State Bureau of Cannabis Control

Model Code Change

CODE ☒ CHECK

New

159

422.16(B)(2) Dishwasher Cords

- ☐ The previous code cycle required the dishwasher receptacle to be in the space adjacent to the dishwasher (not behind it) and allowed the cord length to be 6 ½ ft.
- ☐ This code cycle requires a protective grommet where the cord passes through the cabinet.

Model Code Change

CODE ☒ CHECK

Revision

160

Model Code Change

Article 440 – Air Conditioning & Refrigerating Equipment

440.3(E) California Energy Code Requirements for Heat Pump Space Heaters and their Readiness in Single-Family Buildings.

In single-family residential buildings that include one or two dwellings, each dwelling unit shall be provided with designated spaces, receptacles, branch circuits and circuit identifications as specified for heat pump space heaters in California Energy Code Section 150.0(t).

440.3(F) same for multifamily

New

CODE CHECK

161

Model Code Change

440.9 Rooftop Air Conditioning Units

- ☐ The previous code cycle required a wire type equipment grounding conductor in the circuit to rooftop air conditioning units supplied by conduit with non-threaded fittings.
- ☐ This code cycle changes the words “non-threaded” to “compression type”.

Revision

Older “raintight” fittings did not meet modern listing standards. Listed raintight connectors have identifying features such as bronze collars to indicate they contain the required gland inside the fittings.

©2022 Code Check

162

Model Code Change

Article 480 – Storage Batteries

- ☐ Emergency disconnect required (see 230.85)
- ☐ Plaque or directory required in installations where emergency disconnect is required or in facilities with stand-alone systems.

Revision

CODE CHECK

166

California Amendment

Article 625 - Electric Vehicle Power Transfer System

- ☐ The title of the article was changed

625.1.1 Comply with California Green Building Standards Code Chapter 4, Division 4.1, and Chapter 5, Division 5.1

New Cross-Reference

CODE CHECK

169

Model Code Change

Article 625 - Electric Vehicle Power Transfer System

625.54 Ground-Fault Circuit-Interrupter Protection for Personnel. In addition to the requirements in 210.8, all receptacles installed for the connection of electric vehicle charging shall have ground-fault circuit-interrupter protection for personnel.

625.56 Receptacle Enclosures. All receptacles installed in a wet location for electric vehicle charging shall have an enclosure that is weatherproof with the attachment plug cap inserted or removed. An outlet box hood installed for this purpose shall be listed and shall be identified as extra duty. Other listed products, enclosures, or assemblies providing weatherproof protection that do not utilize an outlet box hood shall not be required to be marked extra duty.

CODE ~~W~~ CHECK

New

172

Too Good to be True???**Easily Share Your Dryer and EV Charger**CODE ~~W~~ CHECK

173

Model Code Change

Article 680 – Swimming Pools, Fountains, Similar Installations**680.21 Motors**

(C) GFCI Protection. Outlets supplying all pool motors on branch circuits 150 volts or less to ground and 60 amperes or less, single or 3-phase, shall be provided with Class A GFCI protection.

Exception: listed low-voltage motors not requiring grounding, below the low-voltage contact limit, and supplied by pool-type xformer.

(D) This applies to pump motors replaced for maintenance or repair.

CODE ~~W~~ CHECK

Revision

176

Model Code Change

Article 680 – Swimming Pools, Fountains, Similar Installations**680.22(A)(5) Pool Equipment Room**

At least one GFCI-protected 125-volt 15- or 20-amp receptacle on a general-purpose circuit shall be located within a pool equipment room, and all other receptacles within the room to be GFCI-protected.

CODE ~~W~~ CHECK

New

177

Article 680 – Swimming Pools, Fountains, Similar Installations

680.22(E) Other Equipment

Other equipment with ratings exceeding the low-voltage contact limit shall be located at least 5 feet horizontally from the inside walls of a pool unless separated by a solid fence, wall, or other permanent barrier.

An example might be an electrical panel on the exterior wall in a back yard with a pool that is close to the house.

Model Code Change **New**

CODE ☒ CHECK

178

Article 680 – Swimming Pools, Fountains, Similar Installations

680.26 Equipotential Bonding

(2) Perimeter Surfaces

(c) Copper Grid

A copper grid is now allowed in lieu of a copper ring for perimeter areas where structural steel is not available or is encapsulated.

Model Code Change **New**

CODE ☒ CHECK

179

Code ☒ Check

Equipotential Bonding

Elements shown here must be part of the equipotential bonding grid

Metal awning

Metal window frame <5 ft. to pool edge

Bonding grid min. 3 ft. past pool edge

Encapsulated structural reinforcing steel

Unencapsulated structural reinforcing steel

Cu conductor grid, #8 bare solid wire in 12 in. x 12 in. grid conforming to pool contour

A or **B** must be installed for conductive pool shells

©2022 Code Check

Model Code Change **New**

180

Article 690 – Solar Photovoltaic (PV) Systems

FIG. 92 PV & Energy Storage Systems

SERIES-CONNECTED DC ARRAY:

PV source circuit → DC → PV output circuit

Fuse

DC-to-DC converter

Module (a.k.a. "panel")

Array

Solar cells

AC MODULE SYSTEM:

AC Modules with integral inverters

PV System Disconnect

Utility Source

Model Code Change **Revision**

CODE ☒ CHECK

183

Article 690 – Solar Photovoltaic (PV) Systems

AC COUPLED MULTIMODE SYSTEM:

CODE ☒ CHECK

184

Article 690 – Solar Photovoltaic (PV) Systems

690.4(B) Equipment. Inverters, modules, panels, AC modules & AC module systems, DC-to-DC converters, DC combiners, RS equipment, DC controllers, & charge controllers listed or field evaluated for PV applications

690.13(A) Photovoltaic Disconnecting Means. Where disconnecting means >30V readily accessible to unqualified persons, enclosure to be locked or require a tool to open

CODE ☒ CHECK

185

690.12 – Rapid Shutdown

- ☐ PV systems on buildings req rapid shutdown function
- ☐ "Array Boundary" = 1 ft. from array in all directions
- ☐ "Controlled Conductors" = PV system DC circuits & inverter output circuits originating from inverters *within the array boundary*
- ☐ Outside the array boundary RS to limit voltage between any 2 conductors or conductor to ground to 30V within 30 seconds
- ☐ Inside the array boundary RS to limit voltage between any 2 conductors or conductor to ground to 80V within 30 seconds
- ☐ In lieu of above, a listed PV hazard control system installed in accordance with manufacturer's instructions
- ☐ Equipment that performs the actual shutdown (other than initiation devices) must be listed for the purpose

CODE ☒ CHECK

188

Rapid Shutdown Initiation Device

- ☐ Initiation device must clearly indicate "off" position
- ☐ In 1&2FD, initiation device readily accessible outdoors
- ☐ For a single PV system, initiation device one of the following
 - Service disconnecting means
 - PV system disconnecting means
 - Readily accessible switch w/clearly marked "ON" & "OFF" position
- ☐ For a multiple PV systems on a single service, initiation device(s) must consist of ≤6 grouped switches or sets of breakers

CODE ☒ CHECK

189

Model Code Change

Rapid Shutdown Signage & Labeling

- ❑ Permanent label at service equipment location must indicate location of RS initiation devices
- ❑ RS initiation device requires label within 3 ft. of switch stating RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM
- ❑ Buildings w/ ≥ 1 RS type or w/ no RS req detailed plan view diagram of roof showing each different PV system w/ a dotted line around areas that remain energized after RS is initiated

FIG. 96 Required Label at Rapid Shutdown Switch

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

Label must be reflective, all caps, min. $\frac{3}{16}$ in. white on red, within 3 ft. of switch

Revision

CODE ~~W~~ CHECK

190

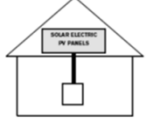
Model Code Change

Rapid Shutdown Signage & Labeling

FIG. 95 Required Label at Electrical Service

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY



Label must be all caps, top min. $\frac{3}{16}$ in. black on yellow, left min. $\frac{5}{16}$ in. black on white

Revision

CODE ~~W~~ CHECK

191

Model Code Change

Rapid Shutdown Signage & Labeling

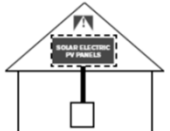
FIG. 97 Label When Areas Remain Energized after Shutdown

Dotted lines required around areas that remain energized.

This label was specified in the 2017 NEC for systems allowed to remain energized inside the array boundary. All caps, top min. $\frac{3}{16}$ in. white on red, left min. $\frac{5}{16}$ in. black on white, red diagram of energized area

SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN CONDUCTORS OUTSIDE THE ARRAY. CONDUCTORS WITHIN THE ARRAY REMAIN ENERGIZED IN SUNLIGHT.



Revision

CODE ~~W~~ CHECK

192

Model Code Change

Other Markings & Labels

FIG. 98

PV SYSTEM DISCONNECT
690.13B Each PV system disconnecting means

WARNING
3 POWER SOURCES: UTILITY GRID, BATTERY, AND PV SOLAR ELECTRIC SYSTEM
705.10 & 706.21 At service with plaque or directory showing location of sources

WARNING
THIS EQUIPMENT FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE SHALL NOT EXCEED AMPACITY OF BUSBAR
705.12B(3) - Install at panels that combine multiple inverter output sources. See F909

Labels

WARNING PHOTOVOLTAIC POWER SOURCE
690.31D2 - Label reflective, all caps, min. $\frac{1}{8}$ in. white on red. Apply at each section of exposed raceways, cable trays, pull & j-box covers & conduit bodies with unused openings. Max. spacing 10 ft. Must appear on every section separated by enclosures, walls, partitions, ceilings, or floors.

DIRECT CURRENT MAXIMUM VOLTAGE XXX V
690.53B Install at inverter, disconnecting means, or distribution equipment

WARNING - PV OUTPUT CIRCUIT
DO NOT RELOCATE THIS OVERCURRENT DEVICE
705.12B(2) On deadfront cover. See F909

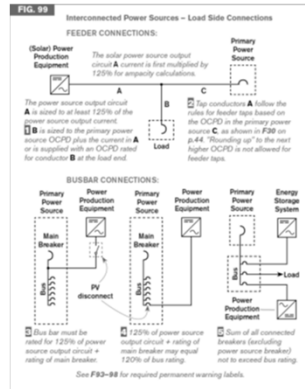
WARNING
ELECTRIC SHOCK HAZARD TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION
690.13B Usually at inverter connections or at disconnect

Revision

CODE ~~W~~ CHECK

193

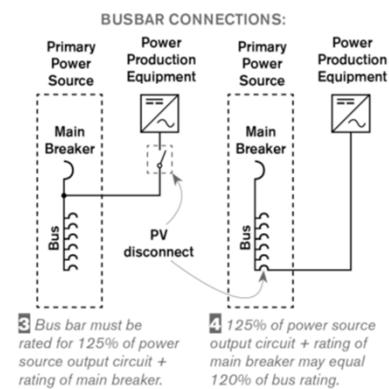
705 – Interconnected Power Sources



CODE CHECK

194

705 – Interconnected Power Sources



CODE CHECK

195

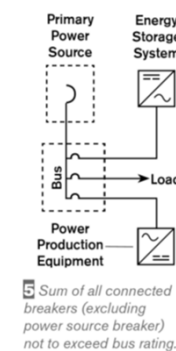
Examples of 120% Rule

- 100 Amp bus, 100 amp main at one end, 20-amp PV at opposite end.
- 125 Amp bus, 100 amp main at one end, 50-amp PV at opposite end.
- 200 Amp bus, 200 amp main at one end, 40-amp PV at opposite end.
- 200 Amp bus, 175 amp main at one end, 50-amp PV at opposite end.
- 225 Amp bus, 200 amp main at one end, 70-amp PV at opposite end.

CODE CHECK

196

705 – Interconnected Power Sources



CODE CHECK

197

705 – Interconnected Power Sources

FEEDER CONNECTIONS:

(Solar) Power Production Equipment
The solar power source output circuit **A** current is first multiplied by 125% for ampacity calculations.

Primary Power Source

The power source output circuit **A** is sized to at least 125% of the power source output current.
1 **B** is sized to the primary power source OCPD plus the current in **A** or is supplied with an OCPD rated for conductor **B** at the load end.

2 Tap conductors **A** follow the rules for feeder taps based on the OCPD in the primary power source **C**, as shown in **F30** on p.44. "Rounding up" to the next higher OCPD is not allowed for feeder taps.

Load

CODE ~~W~~ CHECK

198

705 – Interconnected Power Sources

- ☐ **705.13 Power Control Systems.** PCS that limits source outputs can be used to limit currents on bus bars and conductors
- ☐ PCS-controlled circuits + all monitored circuits from other supply sources not to exceed ampacity of bus or conductors
- ☐ Access to PCS settings restricted to qualified personnel.
- ☐ Functionality as an overcurrent device may be in product listing.

CODE ~~W~~ CHECK

199

706 – Energy Storage Systems (ESS)

- ☐ **706.3.** Installation & maintenance only by qualified personnel
- ☐ Nameplate to include manufacturer, frequency, phases, kW or kVA, available fault current, maximum output & input current & voltage & interactive capability.
- ☐ ESS must be listed.
- ☐ Disconnect must be readily accessible.
- ☐ 1- & 2-family dwellings require disconnect or its remote control on the building exterior

CODE ~~W~~ CHECK

202



203