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Doug Smith, MCP/CBO

- ❑ Inspector/Plan Reviewer for over 19 years
- ❑ 19 ICC certifications
- ❑ Certified ICC Master Code Professional and CBO
- ❑ Taught electrical, solar PV, and ESS classes for over 13 years
- ❑ Performed well over ten-thousand electrical, solar PV, and ESS plan reviews
- ❑ Serve on *NEC* CMP 10 representing IAEEI
- ❑ Currently serve as a Technical Committee (TC) Member for the following UL standards:
 - UL 61730 (previously 1703) – Flat-Plate PV Modules and Panels
 - UL 1741 - Inverters, Converters, Controllers, and Int. equip...
 - UL 2703 – PV Mounting Systems/Clamps/Gnd. Lugs
 - UL 6703 – Connectors for Use in PV Systems
 - UL 9540 - Energy Storage Systems and Equipment

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Course Objective/Intent

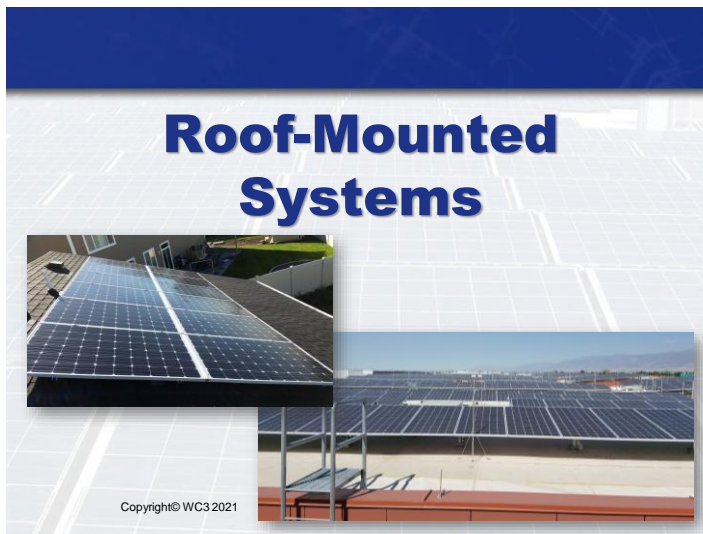
- ❑ The objective of this presentation is to explain the core *NEC/IRC* requirements that govern solar photovoltaic (PV) systems and explain the inspection process for them. This presentation is based on the **2020 NEC and 2021 IRC/IFC**.
- ❑ The intent of this information is to be used as a guide only. This presentation is not intended to indicate any change in any code or local requirements by inference or omission. All diagrams are for illustration purposes only and actual wiring and installation may vary. This presentation is not intended to indicate if one piece or particular brand of equipment is better than another. Also, efficiency and ideal design considerations are not addressed herein. All codes and manufacture requirements must always be followed when designing, installing, and inspecting any electrical system, including solar PV and/or battery systems.

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Outline

1. Roof-mounted systems
2. Ground-mounted systems
3. Point of interconnection requirements
4. General equipment requirements
5. General wiring requirements
6. Signage requirements

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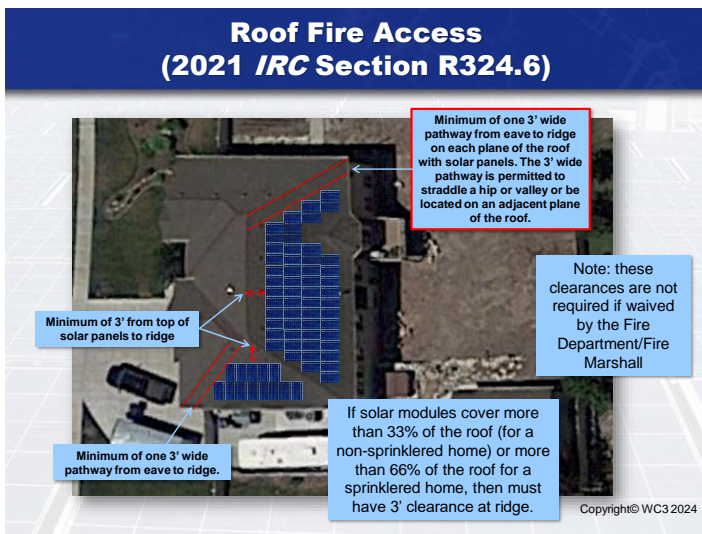
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Roof Fire Access (2021 IRC Section R324.6)

Minimum of one 3' wide pathway from eave to ridge.

Minimum of 18" from top of solar modules to ridge

Minimum of one 3' wide pathway from eave to ridge.

Note: fire spacing clearances are not required for non-habitable detached structures, or for roofs having a slope of 2/12 or less.

If the total roof is not covered by more than 33% with solar modules (panels), then the distance from the panels to the ridge of the home can be not less than 18".

If the home is equipped with a NFPA 13D sprinkler system, the roof is permitted to be covered up to 66% with solar panels.

Note: these clearances are not required if waived by the Fire Department/Fire Marshall

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Roof Access

Violation

Correct

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Access to Egress Openings (IRC R324.6.3)

Cannot block egress openings (3' pathway required)

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2021 IFC Required Pathways On Non-Residential Roofs (1205.3.1-1205.3.3)

(If either axis of the roof is 250 ft. or less)

275 ft.

100 ft.

4'

8'

4'

4'

4'

4'

8'

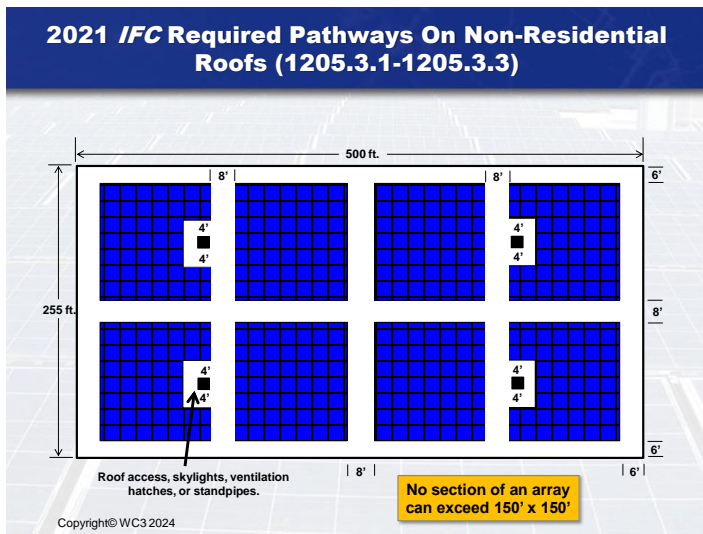
4'

Roof access, skylights, ventilation hatches, or standpipes.

No section of an array can exceed 150' x 150'

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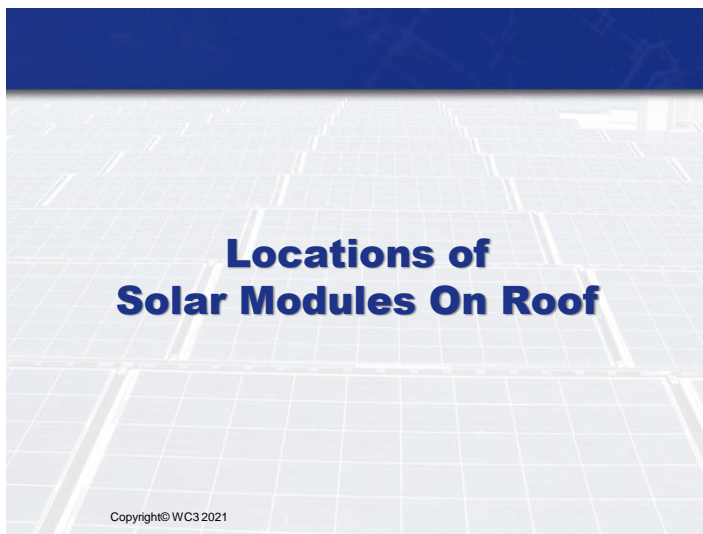
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Roof Installations

- ❑ Most jurisdictions do not allow PV modules to be installed over any plumbing, mechanical, or other types of vents.
- ❑ Modules must not be installed over any openings or equipment that are required to remain accessible.

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Covering Roof Plumbing Vents?

- *IRC P3103.1.3* (of the 2018 *IRC*) says:
 - "Where an open vent pipe terminates above a sloped roof and is covered by either a roof-mounted panel (such a solar collector or PV panel...) or a roof element..., the vent pipe shall terminate not less than 2 inches about the roof surface. Such roof element shall be designed to prevent the adverse effects of snow accumulation and wind on the function of the vent. The placement of a panel over a vent pipe and the design of a roof element covering the vent pipe shall provide for an open area for the vent pipe to the outdoors that is not less than the area of the pipe, as calculated from the inside diameter of the pipe. Such vent terminals shall be protected by a method that prevents birds and rodents from entering or blocking the vent pipe opening."

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Roof Installations (continued...)

Vent re-routing by Solar Roof Jack®

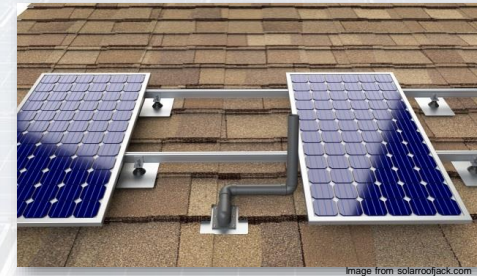


Image from solarroofjack.com

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Roof Racking Supports and Flashing

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Roof Racking Supports



- Roof racking supports must be spaced no more than the maximum spans allowed per the racking manufacture.
- Also, spacing of supports may be required to be closer together when they are located close to the edges or peak of the roof.
- In addition, most engineers require that supports be reasonably staggered from one row of rails (or modules) to the next so not all supports are not sitting on the same trusses.

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Roof Flashings

All roof penetrations must be properly flashed.
IRC 903.2



SolaDeck box (RSTC Enterprises, Inc.)



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Sealing of Roof Penetrations



QuickBOLT®



SnapNrack®



Unirac®

Roof attachment methods should be evaluated for preventing water entry and must be installed per their installation instructions.

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Roof Flashings Are Required!



Violations!



23

Roof flashing required!



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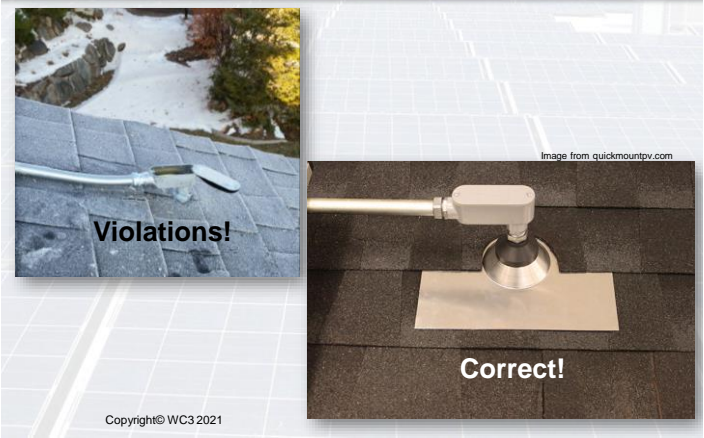
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Roof Flashings Continued...



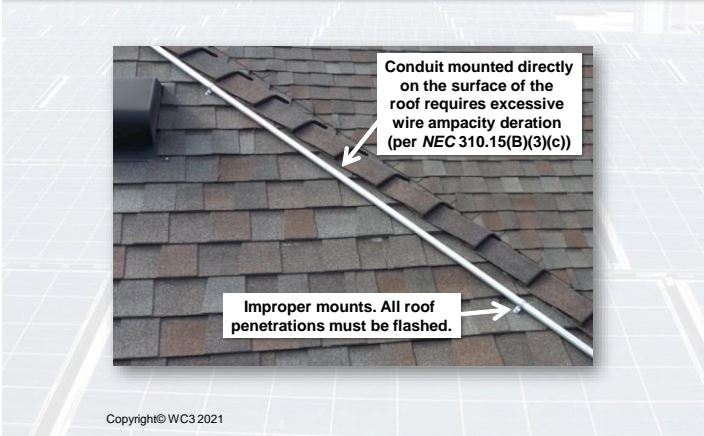
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Roof flashing required!



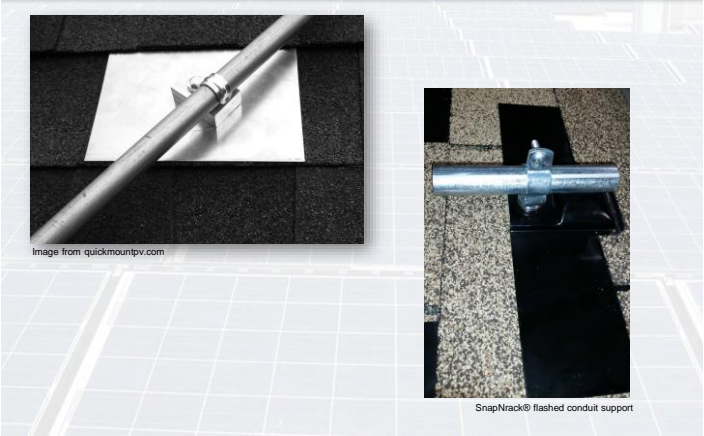
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Improper Conduit Installation



27

Roof flashing required!



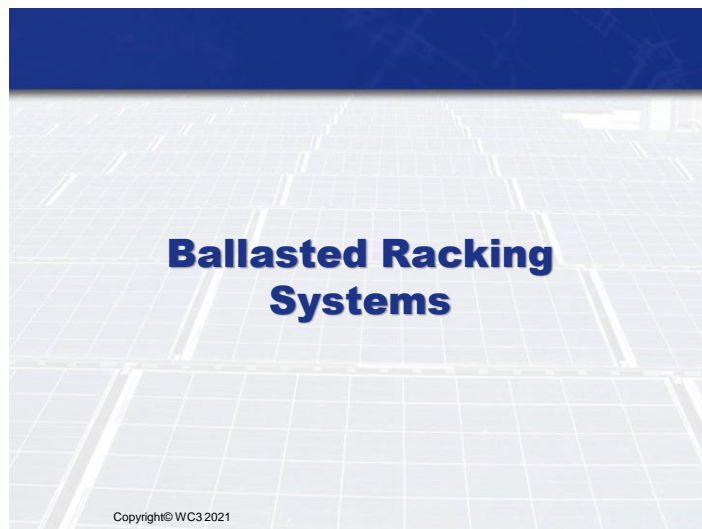
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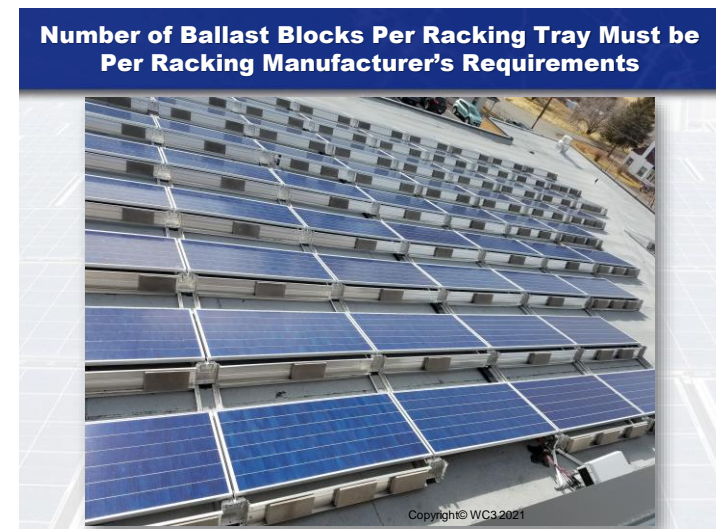
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Structural Integrity

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Wiring at Array

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Wiring Under Modules



All wires must be neatly tucked up under the modules or in the rails to protect from water and ice damage. NEC 300.4

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Installation Errors



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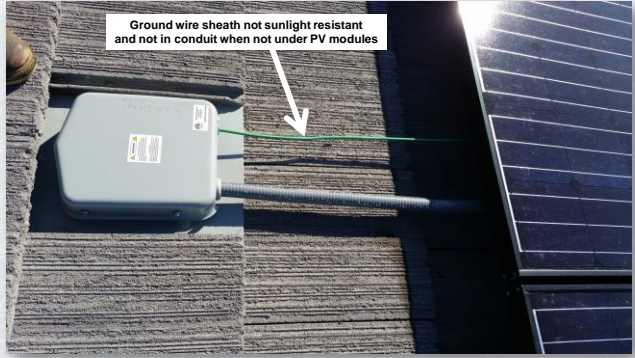


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Installation Errors



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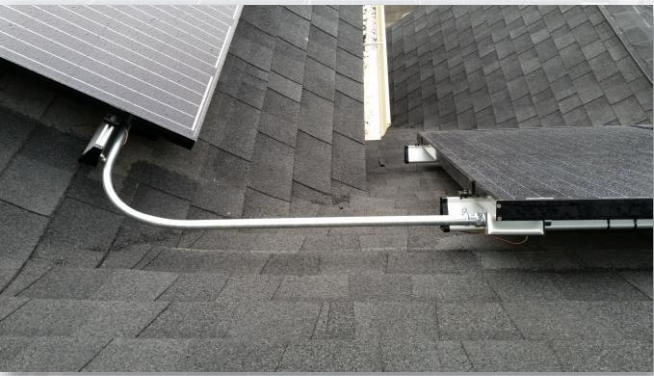
Installation Errors



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Corrected



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Wire Management

Some racking systems provide channels for wiring to be installed within.

Wiring must be installed so not subject to any sharp edges and wiring must maintain its required bending radius (no kinks!).

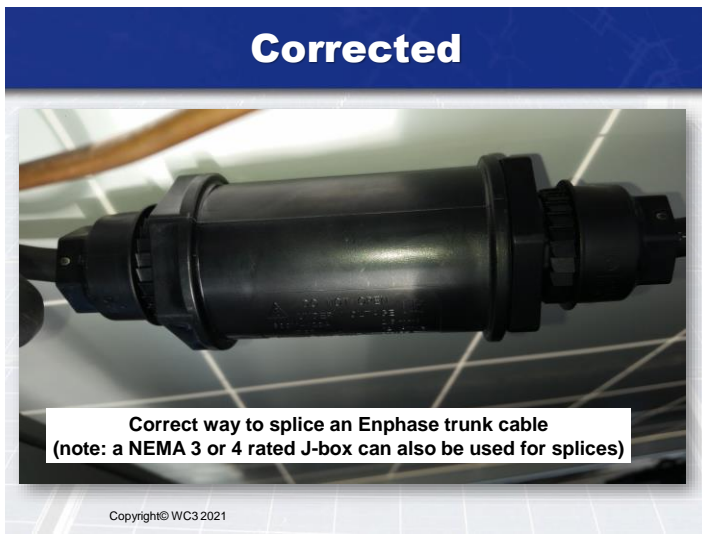


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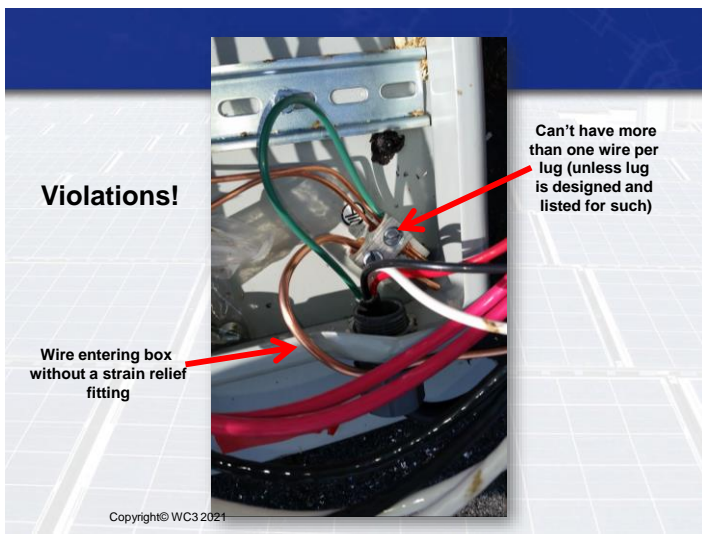
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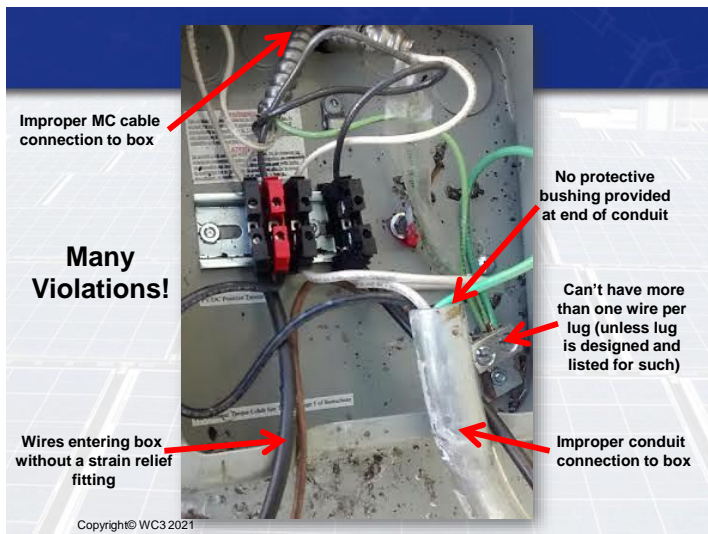
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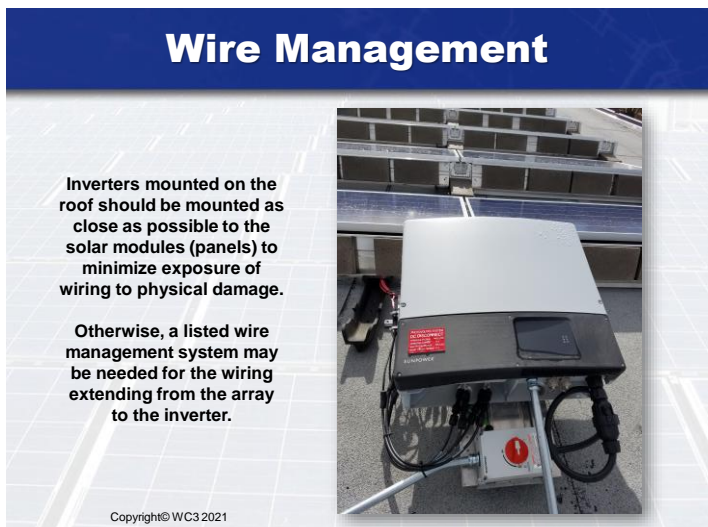
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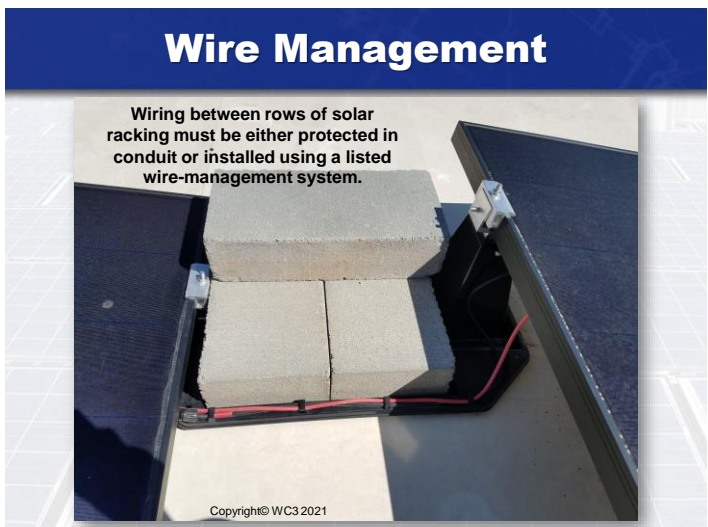
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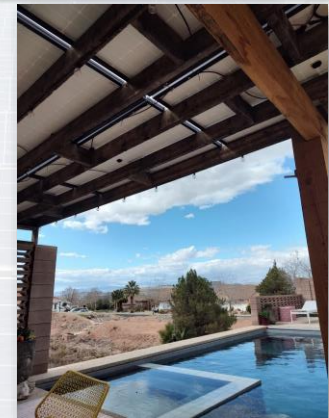
52

Wire Management



53

Installation Errors



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Systems must be maintained in a safe condition (*IFC 603*)



55

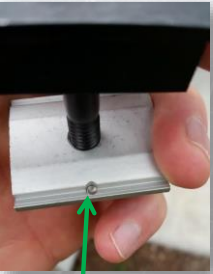
Grounding and Bonding at the Array

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Racking With Integrated Bonding

SnapNrack® racking with integrated bonding




Bonding ring digs into rails



T-clamp pin digs into the PV modules (panels)


Unirack® racking with integrated bonding



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Racking With Integrated Bonding



SnapNrack® racking with integrated bonding


- ❑ Racking systems should be listed per UL 2703.
- ❑ Parts designed for bonding should be tested per UL 467.




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Bonding Support Rails



WEEBL 6.7 assembly
(Wiley Electric/Burndy)



WEEBL Grounding Lug




Note: Rails or other mounting structures that are used for grounding purposes shall be identified as equipment grounding conductors or shall have identified bonding jumpers or devices connected between the separate sections of rails, *NEC 690.43(B)*.


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Listed “Lay-In” Lugs For Bonding Rails Or Modules




Burndy CL50-1TN



WEEBL 6.7
(Wiley Electric/Burndy)



~~ILSCO GBL-4DB (copper)~~



ILSCO GBL-4DBT (tin plated)

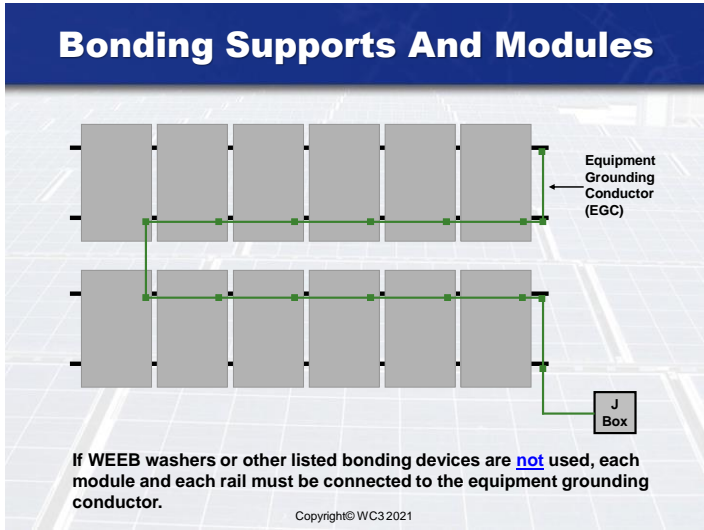
- ❑ Module manufacture should provide instructions on how to properly ground their modules and specify the hardware that should be used.
- ❑ There are few listed lay-in lugs that are approved to be installed in direct contact with aluminum AND be installed outdoors.

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Bonding With “Lay-In” Lugs

- ❑ If each module is going to be individually grounded with a listed lay-in lug, the lug can only be attached to the designated point on the module indicated by the manufacture, UL 1703.

Photo courtesy of John Wiles and New Mexico State University

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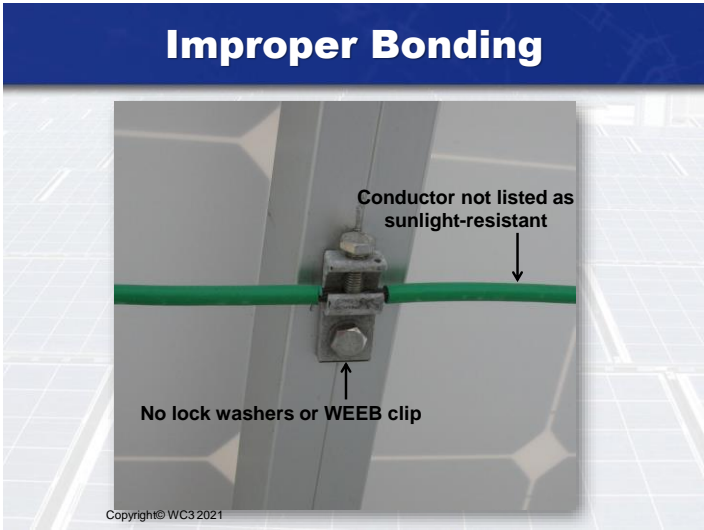
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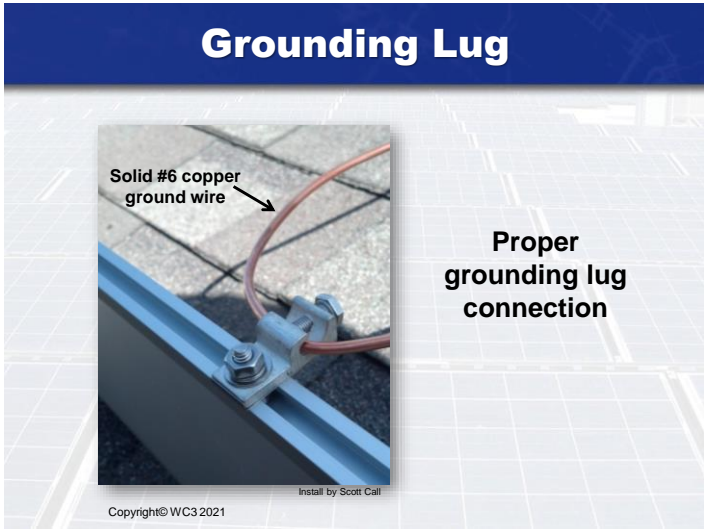
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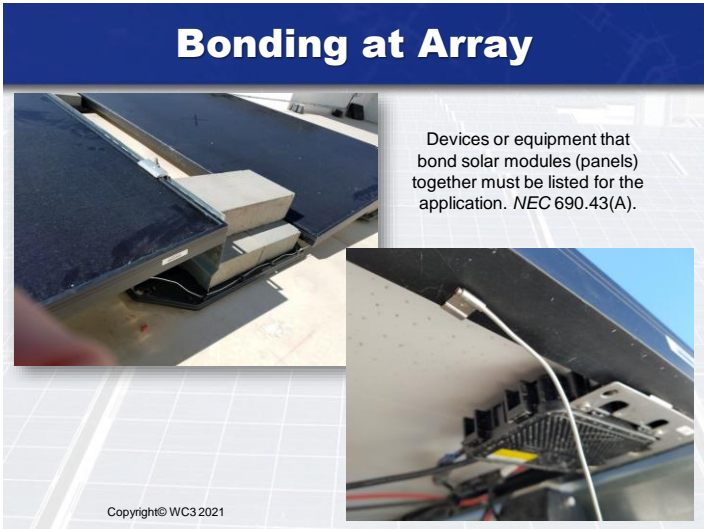
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Bonding at Conduit

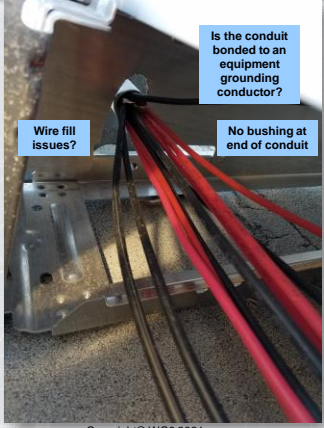


Verify that any bond bushings and ground lugs used outdoors are listed for wet locations (they will often also be listed for direct burial). NEC 110.3(B).

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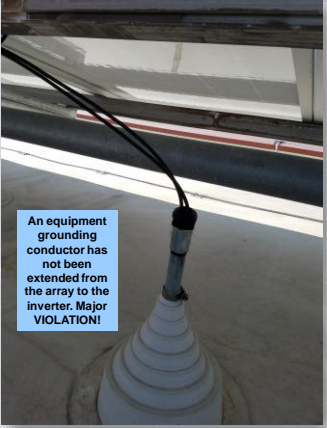
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Installation Errors



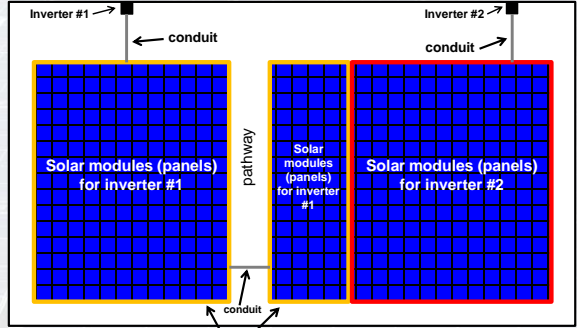
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Required Equipment Grounding Conductor Must Extend to Inverter

The equipment grounding conductor(s) which connect to racking and solar modules (and other metal parts) must extend to the inverter served!



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Rapid Shutdown



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Rapid Shutdown

690.12(B) Controlled Limits:

- The use of the term **array boundary** in this section is defined as **(1 ft) from the array in all directions (and 3' into the attic)**. Controlled conductors outside the array boundary shall comply with *NEC* 690.12(B)(1) and inside the array boundary shall comply with 690.12(B)(2).



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Rapid Shutdown

- **(B)(1) Outside the Array Boundary.** “Controlled conductors located outside the boundary or more than **(3 ft)** from the point of entry inside a building shall be limited to not more than **30 volts within 30 seconds** of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.”

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Rapid Shutdown

690.12(B)(2) Inside the Array Boundary:

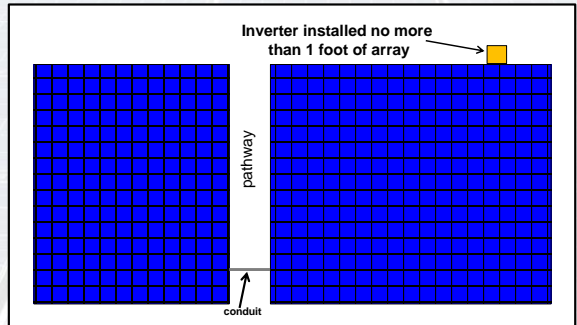
- The PV system must comply with *one* of the following:
 - (1) “A PV hazard control system listed for the purpose (per **UL 3741**) shall be installed in accordance with the instructions included with the listing or field labeling. Where a hazard control system requires initiation to transition to a controlled state, the rapid shutdown initiation device required in 690.12(C) shall perform this initiation.”
 - (2) “Controlled conductors located **inside the boundary** or not more than (3 ft) from the point of penetration of the surface of the building shall be limited to not more than **80 volts within 30 seconds** of rapid shutdown initiation. Voltage shall be measured between any two conductors and between any conductor and ground.”
 - (3) “PV arrays shall have no exposed wiring methods, no exposed conductive parts, and be installed more than 2.5 m (8 ft) from exposed grounded conductive parts or ground shall not be required to comply with 690.12(B)(2).”

NFPE 70, National Electrical Code

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Non-Residential Buildings

There are currently on the market PV systems available which are listed **UL 3741** as a PV Hazard Control System. Such systems often require the inverter to be installed within 1 foot of the solar array. **ALWAYS follow the manufacturer's installation instructions!!**



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Rapid Shutdown

NEC 690.12(C) Initiation Device:

- ❑ For one-and-two family dwellings, the initiation device must be located at a **readily accessible** location on the outside of the building.
- ❑ The rapid shutdown initiation device(s) shall consist of at least one or more of the following:
 - (1) Service disconnecting means.
 - (2) PV system disconnecting means.
 - (3) Readily accessible switch that plainly indicates whether it is in the "off" or "on" position.

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Rapid Shutdown

690.12(C) Initiation Device:

- ❑ New sentence added to the 2020 NEC stating that rapid shutdown for a single system must occur by the operation of a single device.
- ❑ However, there can be up to six initiation devices for rapid shutdown on a single service (if grouped together). Such six initiation devices must shut down all PV systems on a service.



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Rapid Shutdown Initiation Device



Example of an older type of rapid shutdown initiation device – "Birdhouse" solar shut-off device by MidNite Solar



Pushbutton switch



Breaker

The type of rapid shutdown initiation device used will depend on the type of rapid shutdown components of the system.

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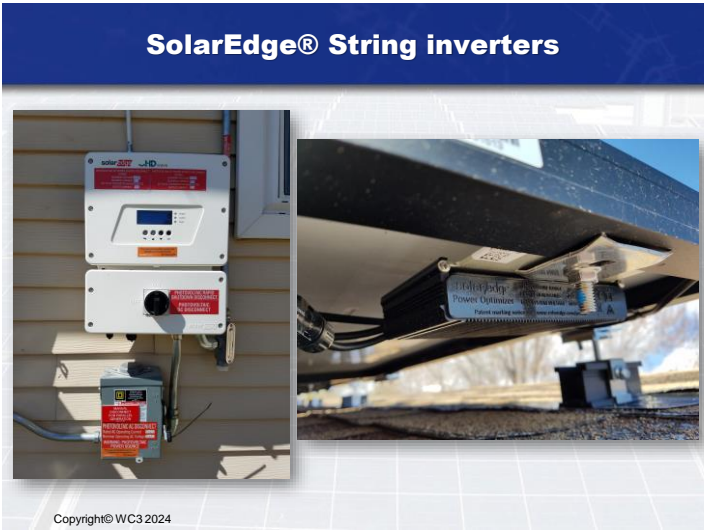
Equipment



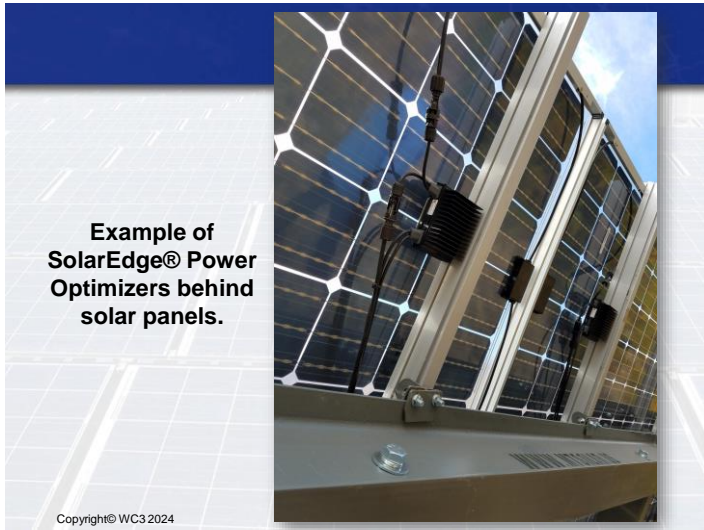
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Equipment that performs the rapid shutdown of the system must be listed for providing rapid shutdown protection. NEC 690.12(D).

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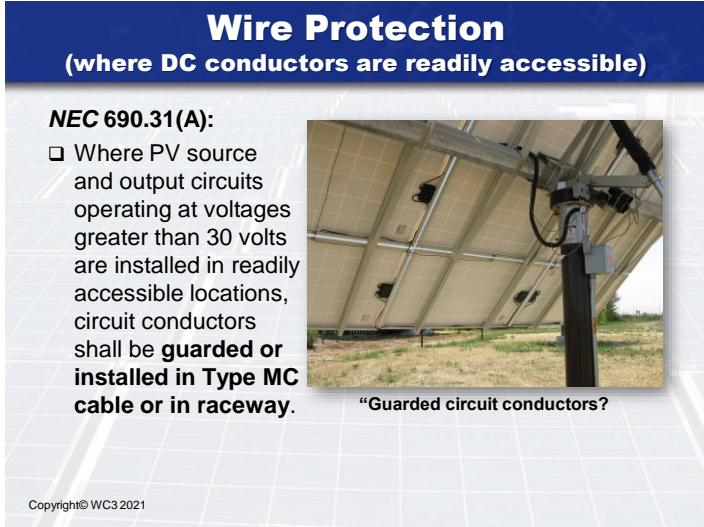
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Wire Protection (where DC conductors are readily accessible)



Wires located in readily accessible locations shall be installed in raceways, MC cable, or be guarded, NEC 690.31(A).

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Barrier around the array?



Would this be a legitimate fence or "barrier" around the array? What say you?

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Barrier around the array?



How about this one? Would this one be a legitimate fence or "barrier" around the array?

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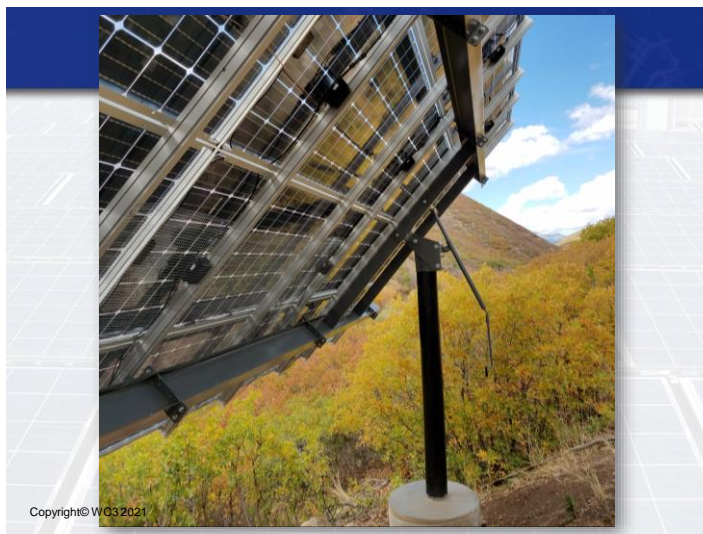
"Guarded" Wiring?



Ground-mount solar array – are wires "guarded"?

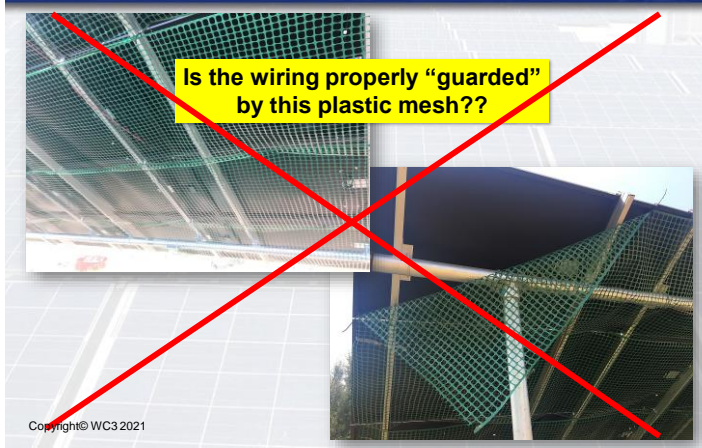
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Covering on back of solar modules??



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Proper support of wiring at ground-mount arrays is important!



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Wire protection at a ground-mount array



Weather heads are a good way to transition from open wiring to conduit at a ground-mount array.

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Ground-Mounted System Racking With Integrated Bonding



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Ground-Mounted System Racking With Integrated Bonding



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Grounding and Bonding



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Equipment at the array



System installed by Ken Gardner

Equipment (such as inverters, disconnects, etc) mounted at a ground-mount array must be rigidly secured in place and must have a 6'6" clear headroom and clear working space directly in front of the equipment. NEC 110.26(A)
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Equipment at the array



Equipment must be protected from damage. NEC 110.27(B)

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Incorrect Ground Mount System



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Incorrect Ground Mount System



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Clearance to Grade



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Point of Interconnection

Point of Interconnection



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Splices and Taps

230.46 – Splices and Taps

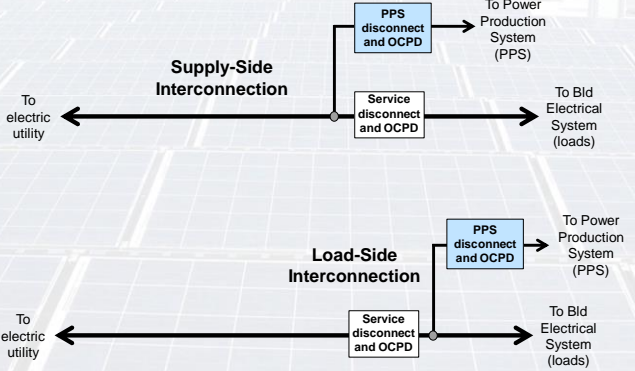
- Any pressure connectors and devices for splicing or taps onto service conductors must be marked “suitable for use on the line side of the service equipment,” or equivalent wording.



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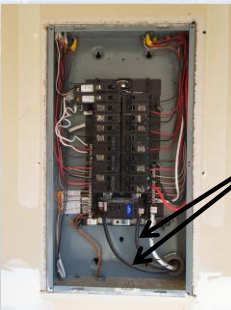
Supply (line) Connections Vs Load Connections



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Supply-Side Interconnection

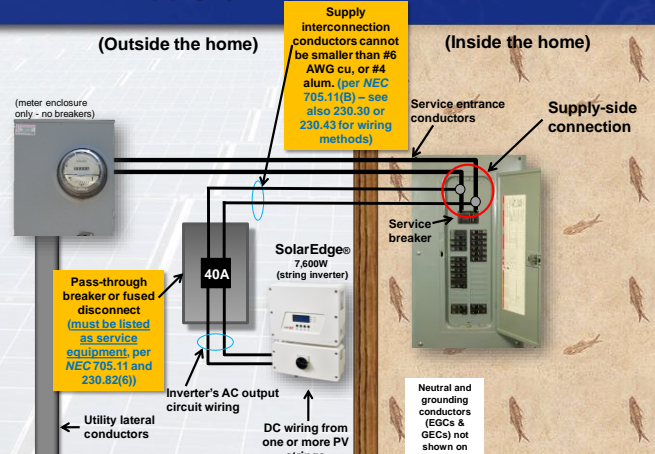
A power production system connection to these service-entrance conductors is ONE example of a supply-side interconnection.

Note: this image is provided to show a basic layout of the service equipment. The intent is NOT to point out every code violation of the install.

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Supply (line) side connection



(Outside the home) (Inside the home)

Supply interconnection conductors cannot be smaller than #6 AWG cu, or #4 alum. (per NEC 705.11(B) – see also 230.30 or 230.43 for wiring methods)

Pass-through breaker or fused disconnect (must be listed as service equipment, per NEC 705.11 and 230.82(6))

Inverter's AC output circuit wiring

DC wiring from one or more PV strings

Service entrance conductors

Service breaker

Supply-side connection

Neutral and grounding conductors (EGCs & GECs) not shown on this slide

(meter enclosure only - no breakers)

SolarEdge® 7.6kW (string inverter)

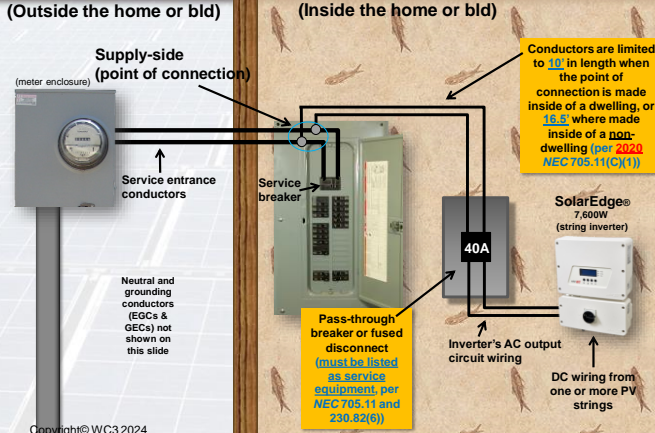
40A

Utility lateral conductors

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Supply (line) side connection (2020 NEC) – Made **Inside** of a Building



(Outside the home or bld) (Inside the home or bld)

Supply-side (point of connection)

Conductors are limited to 10' in length when the point of connection is made inside of a dwelling, or 15.5' where made inside of a non-dwelling (per 2020 NEC 705.11(C)(1))

Pass-through breaker or fused disconnect (must be listed as service equipment, per NEC 705.11 and 230.82(6))

Inverter's AC output circuit wiring

DC wiring from one or more PV strings

Service entrance conductors

Service breaker

Neutral and grounding conductors (EGCs & GECs) not shown on this slide

SolarEdge® 7.6kW (string inverter)

40A

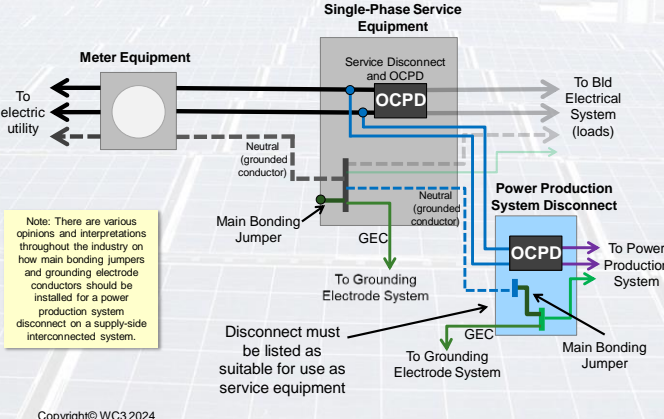
Utility lateral conductors

(meter enclosure)

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Section 250.25 of the 2020 & 2023 NEC (example)



Single-Phase Service Equipment

Meter Equipment

To electric utility

To Bld Electrical System (loads)

To Power Production System

To Grounding Electrode System

To Grounding Electrode System

Main Bonding Jumper

Main Bonding Jumper

GEC

GEC

Neutral (grounded conductor)

Neutral (grounded conductor)

Service Disconnect and OCPD

Power Production System Disconnect

OCPD

Note: There are various opinions and interpretations throughout the industry on how main bonding jumpers and grounding electrode conductors should be installed for a power production system disconnect on a supply-side interconnected system.

Disconnect must be listed as suitable for use as service equipment

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Supply (line) side connection (2020 NEC) – Made Inside of a Building

Supply-side taps (point of connection) made inside the building

480V Service Equipment

1,000A Main

Cable limiters

Existing load breaker

Existing load breaker

Pass-through breaker or fused disconnect (must be listed as service equipment, per CEC 705.11 and 230.82(6))

Note: this method is no longer allowed per the 2023 NEC!

600A

Inverter

AC out

Inverter AC Output circuit (neutrals and grounding conductors not shown)

Max length of 71 feet

Grounded conductors and grounding conductors (EGCs & GECs) not shown on this slide

For non-dwellings, the overcurrent protection device can be located within 71 feet (maximum conductor length) as long as cable limiters are provided for each ungrounded conductor. The cable limiters would need to be within 16.5 feet of the point of connection (maximum conductor length).

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Supply (line) side connection continued...

Examples of cable limiters

Cooper Bussman cable limiter

Ferraz Shawmut cable limiters

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705.11(D) EXAMPLE

Example: does the manufacturer of this service panel allow the factory installed wiring to be tapped?

Does it violate the installation instructions and listing of the equipment?

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111

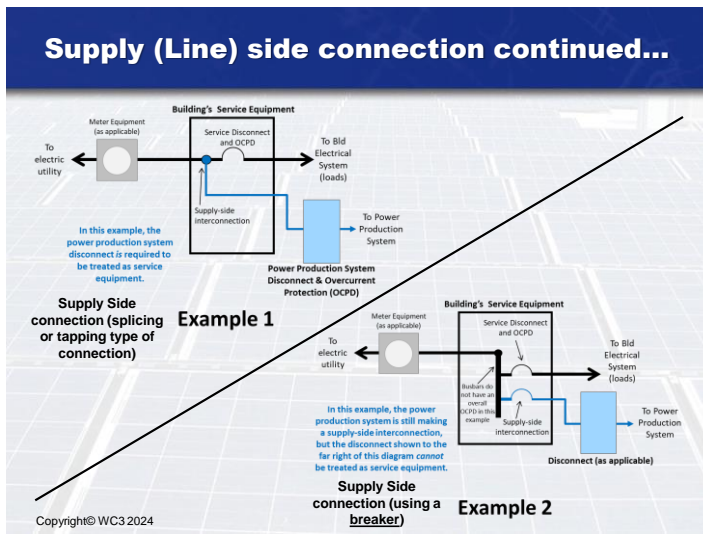
Supply (Line) side connection continued...

What about supply-side connections made with a breaker?

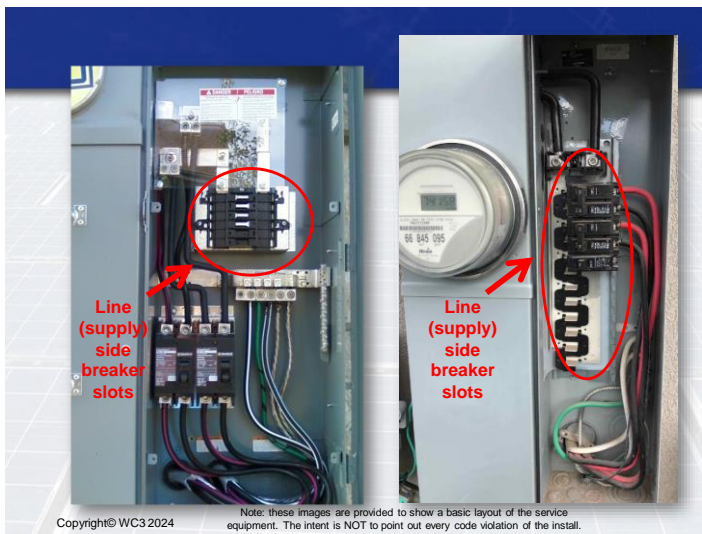
Note: these images are provided to show a basic layout of the service equipment. The intent is NOT to point out every code violation of the install.

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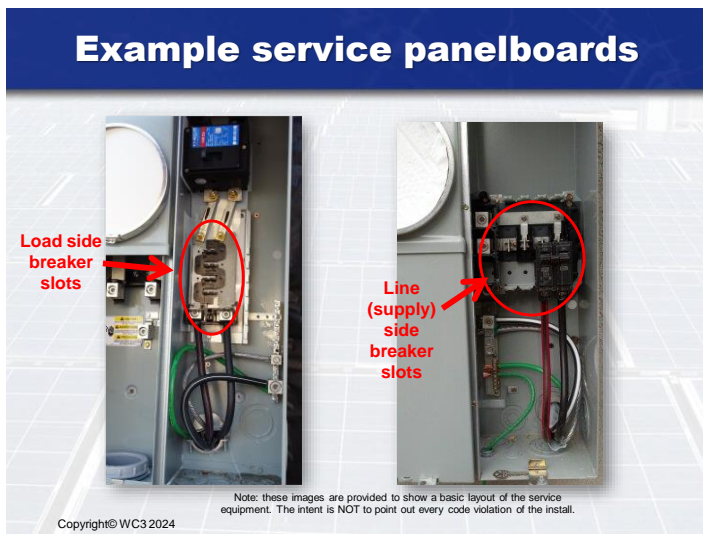
112



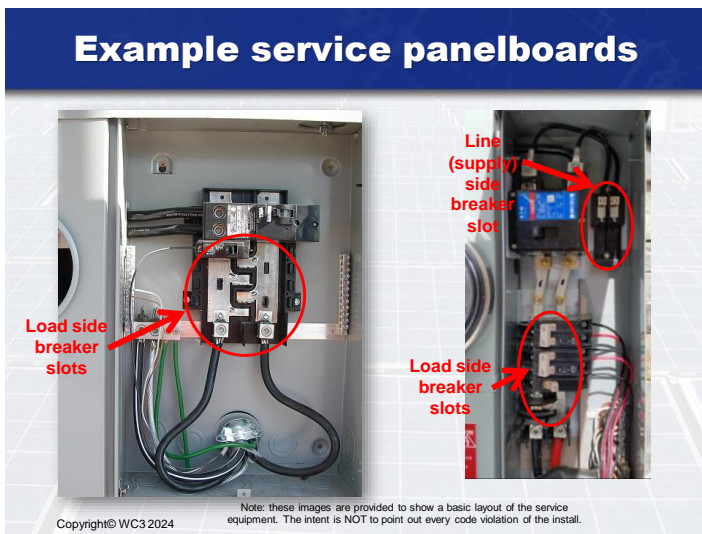
113



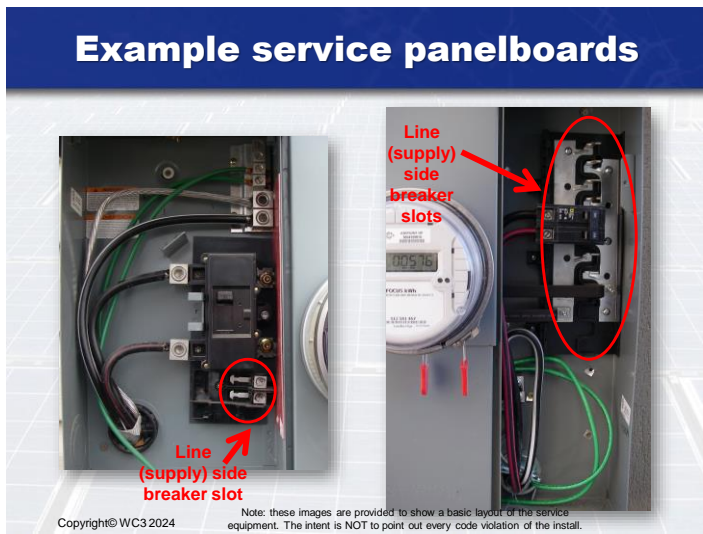
114



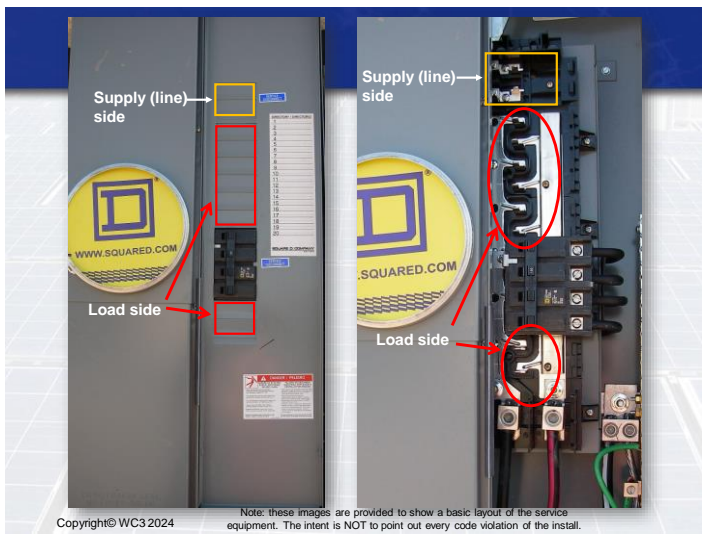
115



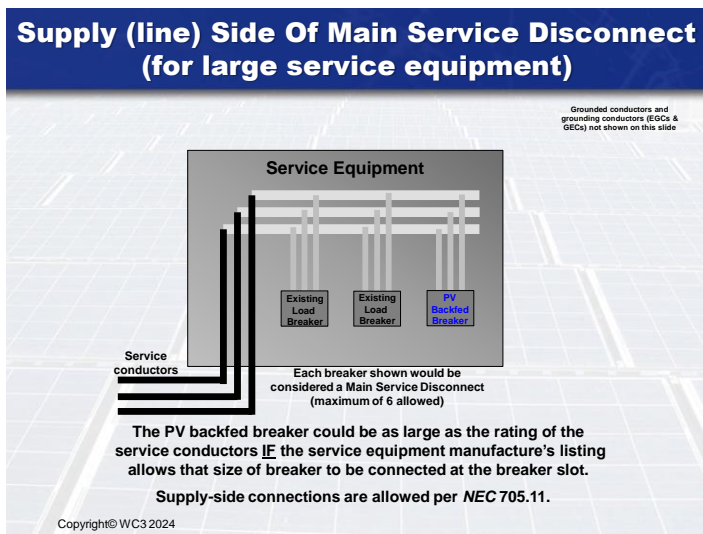
116



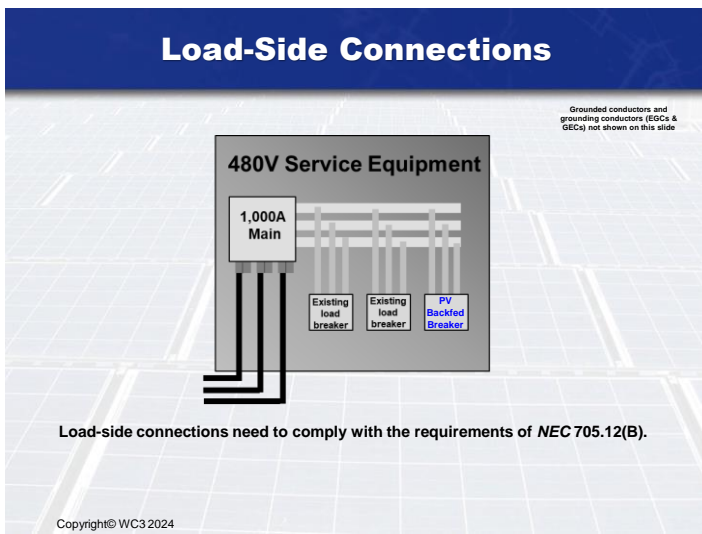
117



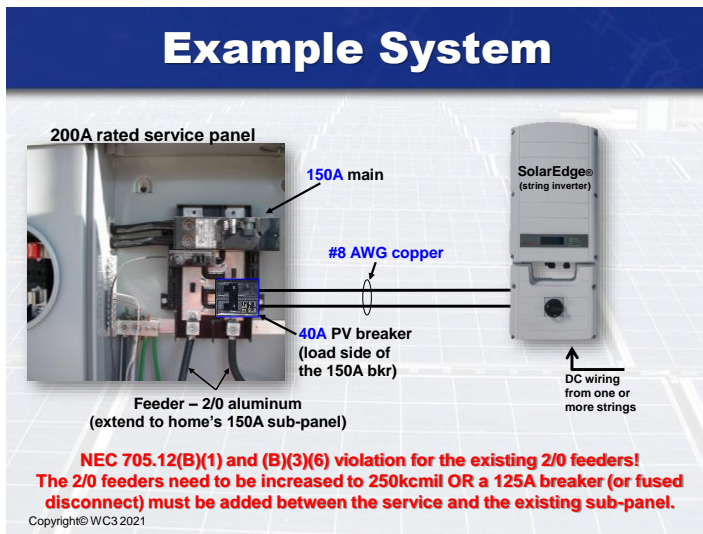
118



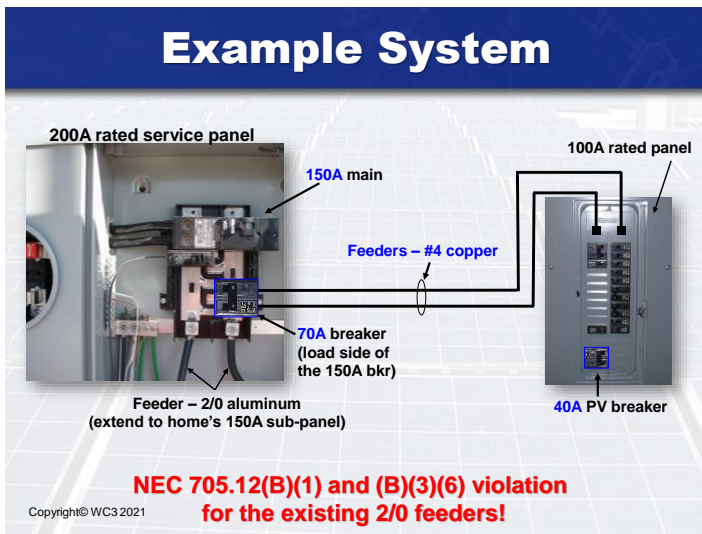
119



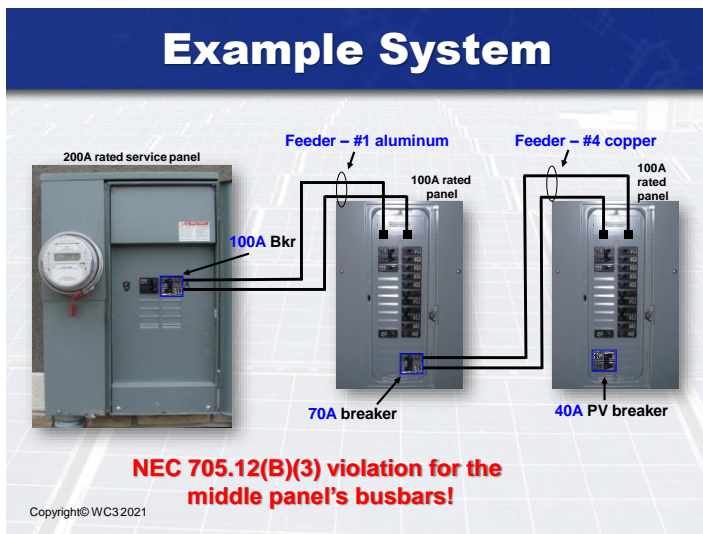
120



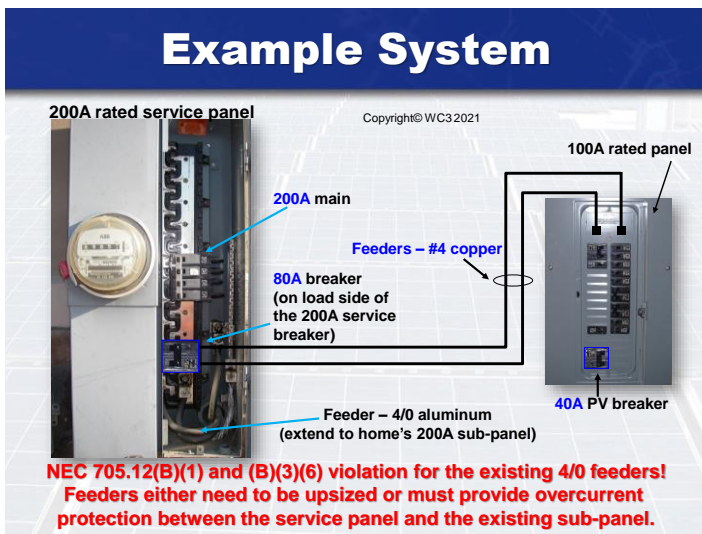
121



122



123



124

NEC 705.12(B)(3)(3)

The main breaker protecting the panelboard does not need to be included, but still must not be larger than the rating of the busbars in the panelboard.

200 amp breaker

4/0 aluminum wire

OK

40 amp PV breaker

200A rated panel

WARNING: THIS EQUIPMENT IS FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE SHALL NOT EXCEED THE RATING OF THE BUSBAR.

The combined ratings of all breakers at the above shown panelboard must not exceed the rating of the panelboard's busbars.

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Service upgrades on old homes?????

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Existing Illegal Wiring and Connections – A BIG PROBLEM!

❑ Most jurisdictions require illegal electrical connections to be corrected prior to the connection of the solar PV system.

Several illegal feeder taps shown in this example

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Illegal Modification of Panel Cover

It's not okay to cut or modify a panel cover!

INVERTER CUTOFF CONNECTION DO NOT RELIQUATE THE OVERCURRENT DEVICE

WARNING

AVERTISSEMENT

ADVERTENCIA

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128

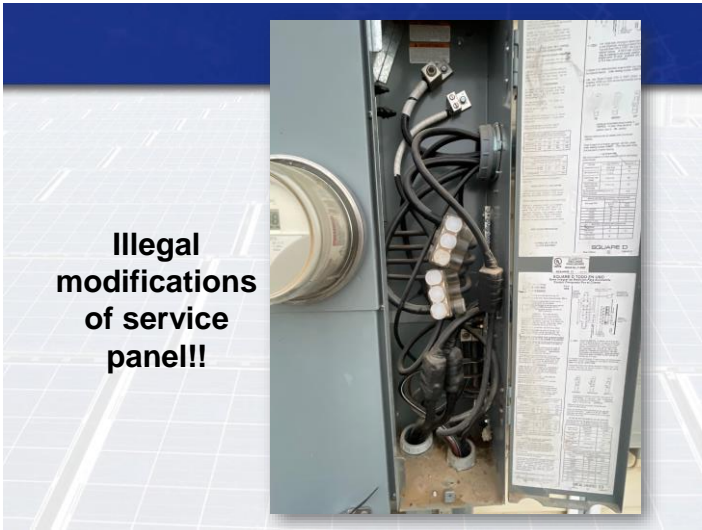
Existing Illegal Wiring (continued...)

Existing illegal code violations need to be corrected!



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Illegal modifications of service panel!!

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Modifications of Equipment?



Cannot drill or modify electrical equipment unless permitted per the manufacturer's instructions, or the modification must be field evaluated for the application (and be field labeled). NEC 110.3(B) and 705.11(C)(2).

131

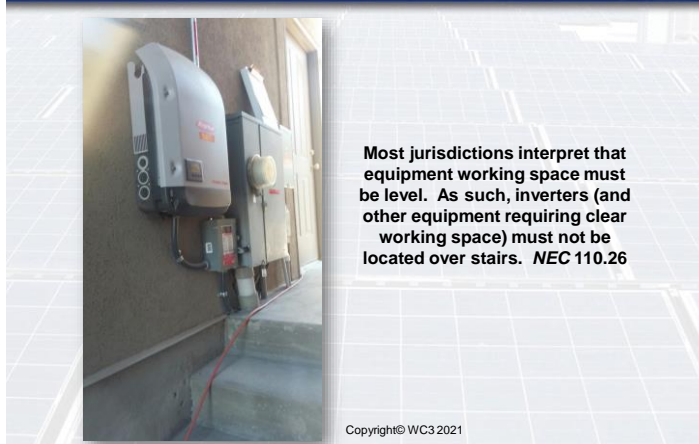
General Equipment Requirements



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132

Working space in front of equipment

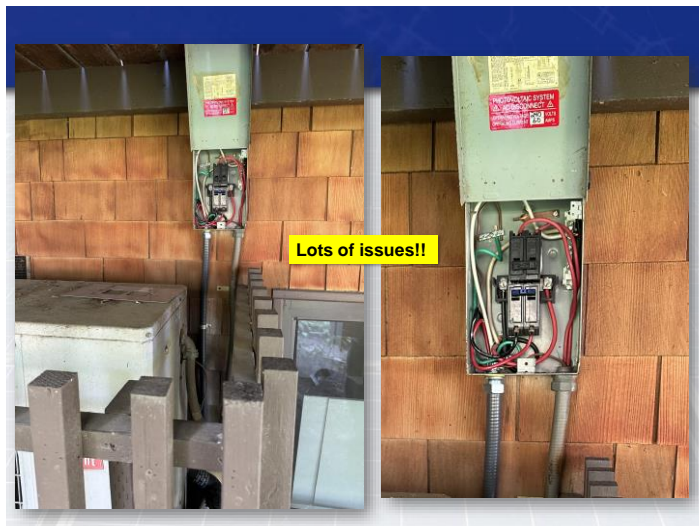


133

Working space in front of equipment?



134



135

Listing of Equipment

Verify that solar modules are listed per UL 1703 (or UL 61730)

SOLARIA	
Solaria PowerXT™ - 490C-PD	
Peak Power (P _{max})	430 W
Voltage at P _{max} (V _{mp})	39.3 V
Current at P _{max} (I _{mp})	10.93 A
Open Circuit Voltage (V _{oc})	47.3 V
Short Circuit Current (I _{sc})	11.43 A
Maximum Service Fuse	20 A

All ratings at standard test conditions: 1000 W/m² AM 1.5 spectrum, 25°C. Field connectors, use min. 12 AWG copper wires installed for 90°C min.

UL-1703 Certified

Verify that inverters, converters, and controllers are listed per UL 1741.



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Disconnects From All Sources



NEC 690.15(A) requires disconnects for inverters from all sources of power. The required disconnect(s) must be within sight and within 10' of the equipment.

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Some Inverters Have Both a DC and an AC disconnect Provided



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Mounting of equipment



Equipment must be properly mounted to a suitable surface and be well secured in place. NEC 110.3 and 110.13(A)

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Equipment located above or below other equipment

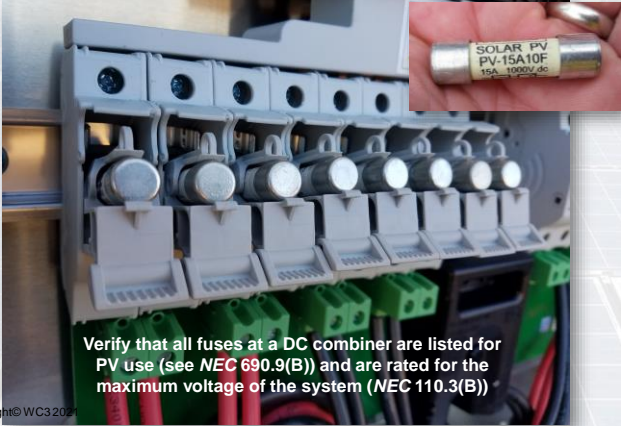


Electrical equipment is permitted to be installed above or below other electrical equipment (if they are associated with the same system), but one piece of equipment cannot project more than 6" from the front of the other adjacent equipment. NEC 110.26(A)(3)

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Fuses at DC Combiners



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Production Meters



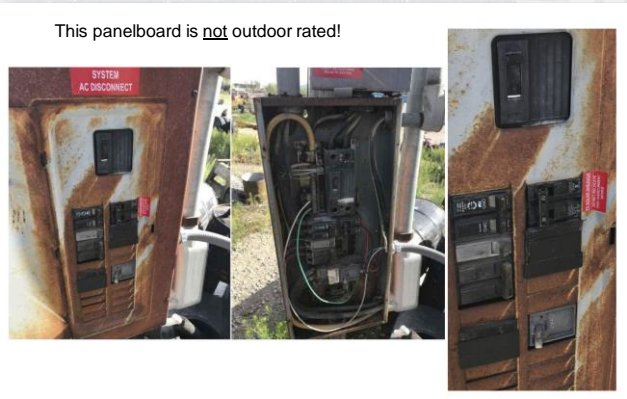
Some utilities and jurisdictions require an extra meter base so a production meter can be added for a PV system. Such meter bases must be listed.

Also, if feeder taps are to be performed in order for connection of the PV system with the home's electrical system, the taps must first extend to an overcurrent protection device (an OCPD such as a fused disconnect) and then the meter base can be added on the load side of such OCPD (ie. the meter base cannot be between the point of taps and the OCPD for the taps). See *NEC 240.21(B)*.

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Equipment must be outdoor rated when outside (*NEC 110.28*)!



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Equipment Violations

Do I really need to explain why this is NOT okay??



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General Wiring Requirements



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145

Fine-Stranded Cable



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146

Welding cable and automobile cable is not a recognized wiring method in the NEC.
 There are USE/RHW and THW fine-stranded cables that are available for battery use.


Fine Stranded Wires

Conductors more finely stranded than class B or C:


- ❑ If fine stranded wires are used they must have terminals identified and listed for such, NEC 110.14.
- ❑ The connectors must meet UL 486 A & B (manufacture listing and installation info is required).



ILSCO FE series



Burndy YA series




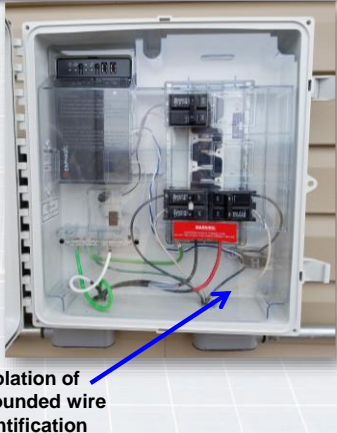
Burndy YE-P-FX
Pin adapter series

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See NEC 110.14 and Chapter 9, table 10 for more info on fine stranded conductors.

147

Identification of Ungrounded Wiring (NEC 310.6 and 200.7(C))

Violation of ungrounded wire identification

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Wiring Methods

690.31(B) - Grouping:

- ❑ Class 1, signaling, and power-limited circuits for PV systems are permitted to be located in the same conduit (raceway), cable assembly, or enclosure as PV **dc** circuits.
- ❑ PV dc circuits are not allowed to be in the same conduit (raceway), cable assembly, or enclosure as non-PV system circuits or inverter output (ac) circuits (unless separated by a barrier or partition).
 - Exception: PV dc circuits are permitted to occupy the same wiring method as inverter output (ac) or non-PV system circuits as long as the dc wiring is part of multi-conductor jacketed cables, MC cable, or listed wiring harnesses.

149

Separation of DC and AC wiring



In this example, are DC wires in the same electrical gutter box as AC wiring?

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Example: Separation of DC Wiring From AC Wiring



151

Violation(s)? Or does this meet the intent of the exception?



Violation(s)? Or does this meet the intent of the exception?

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Example: Separation of DC Wiring From AC Wiring



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153

DC Wiring Within A Building

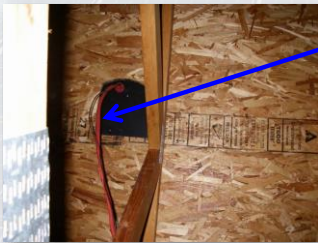


DC wires entering the home or building must be in metal conduit or be MC cable. NEC 690.31(D) – see exception for listed PV hazard control systems.

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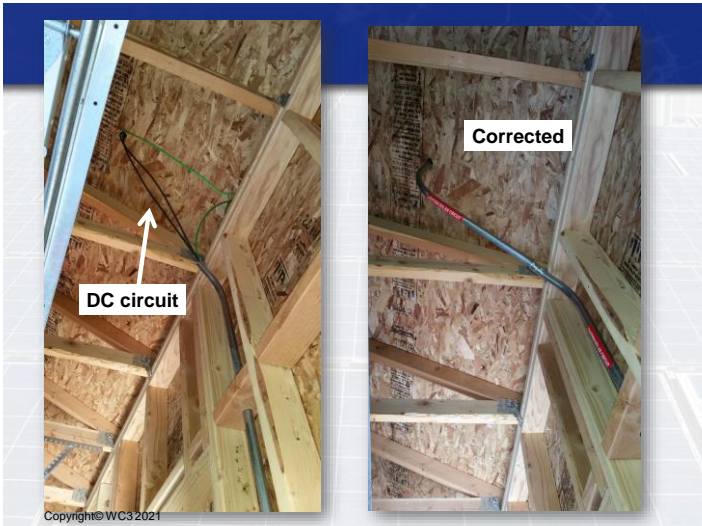
Wiring Within A Building



Nonmetallic sheathed cable (Romex®) may be left exposed inside a home only with micro inverter or AC module systems and if protected from damage (this may also apply to commercial buildings if nonmetallic sheathed cable is permitted).

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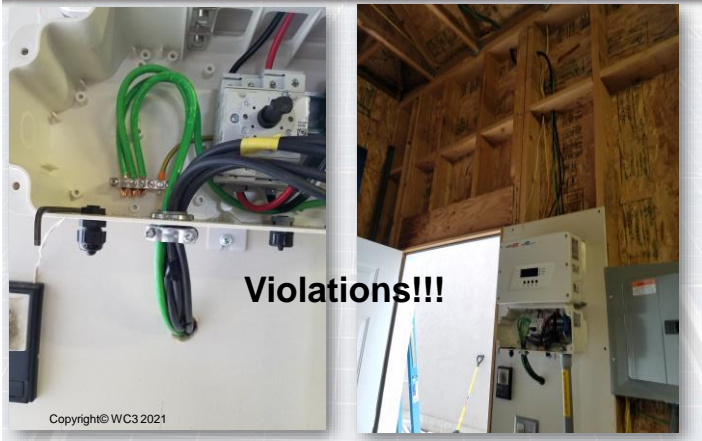
155



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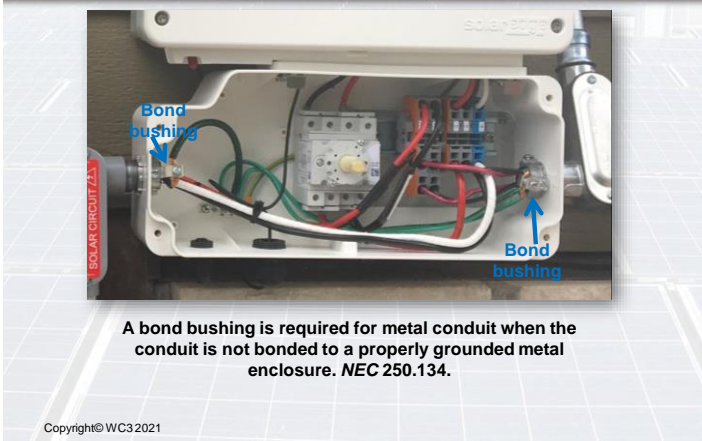
156

Conduit required for individual conductors!



157

Bonding of conduits



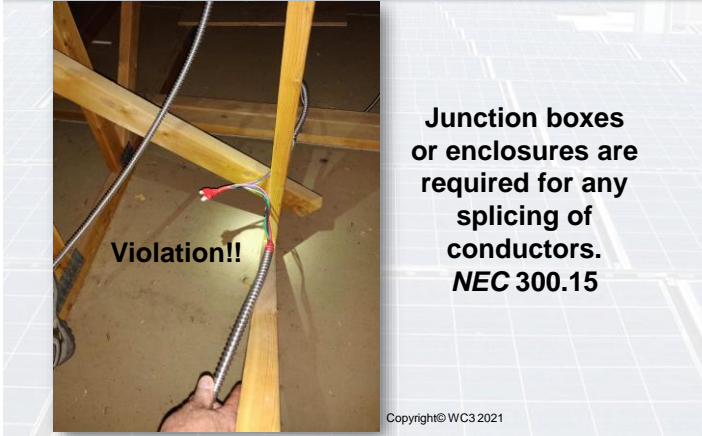
158

Bonding of conduits (continued)



159

Junction Boxes



160

Bonding Sheath of MC Cable



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Example of possible connectors to bond the sheath of the MC cable to the equipment grounding conductor (see exceptions of NEC 314.3):



161

Signage

Signage



Photo from Instagram.com

162

Signage, Per NEC 110.21(B)



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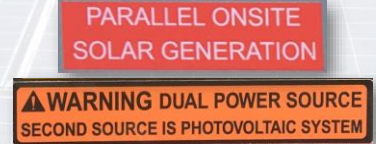
- ❑ Signs must be durable and be able to handle the environment they are installed in.
- ❑ Signage cannot be hand-written.
- ❑ The markings must adequately warn of the hazard using effective words and/or symbols.

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Signage at Service Panel

A sign is required at the service panel stating that the home has a solar PV system as an additional power source. NEC 705.10. Wording can vary for such signage.

Commonly used signs to meet NEC 705.10:

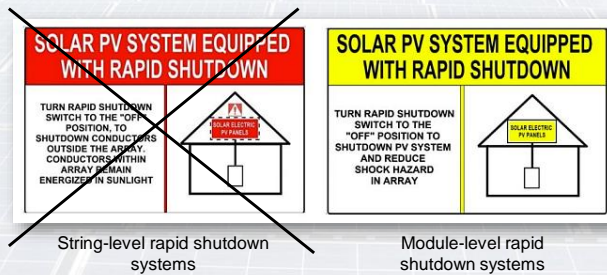


Note: any panelboard with multiple sources of power (ie. Utility and solar) must have a sign noting all sources. NEC 705.12(C).

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Rapid Shutdown Signage



String-level rapid shutdown systems

Module-level rapid shutdown systems

The sign with the red background (as shown above) has been removed from 2020 NEC 690.56(C) as a required sign.

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Rapid Shutdown Signage

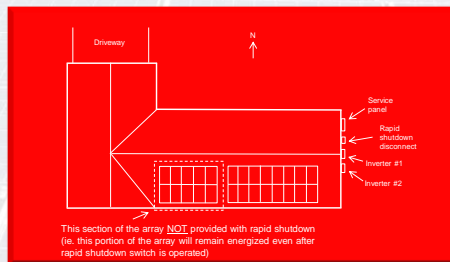
690.56(C)(1) Buildings with More Than One Rapid Shutdown Type:

- For buildings that have PV systems with **both** rapid shutdown types **or** a PV system with a rapid shutdown type and a PV system with no rapid shutdown, a detailed plan view diagram of the roof shall be provided showing each different PV system and a dotted line around areas that remain energized after the rapid shutdown switch is operated.

166

Rapid Shutdown Signage

Example of a plaque showing which portion(s) of the PV system are equipped with rapid shutdown and which are not:



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Rapid Shutdown Signage

- 690.56(C)(2) Rapid Shutdown Switch.** A rapid shutdown switch shall have a label located on or no more than (3 ft) from the switch that includes the following wording: **“RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM”**
- The label shall be reflective, with all letters capitalized and having a minimum height of 9.5 mm (3/8 in.), in white on red background.

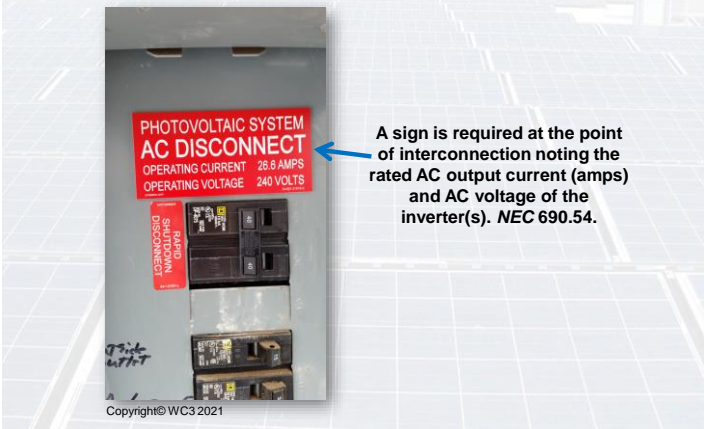
**Rapid Shutdown Switch
For Solar PV System**

Sign located next to the rapid shutdown disconnect (and must be reflective)

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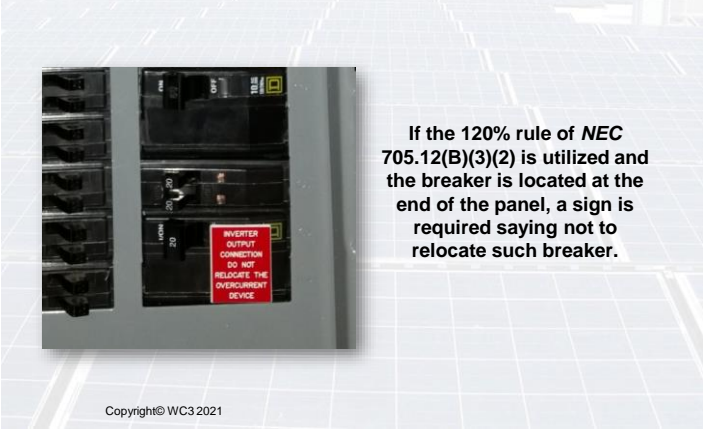
168

Sign at Point of Interconnection



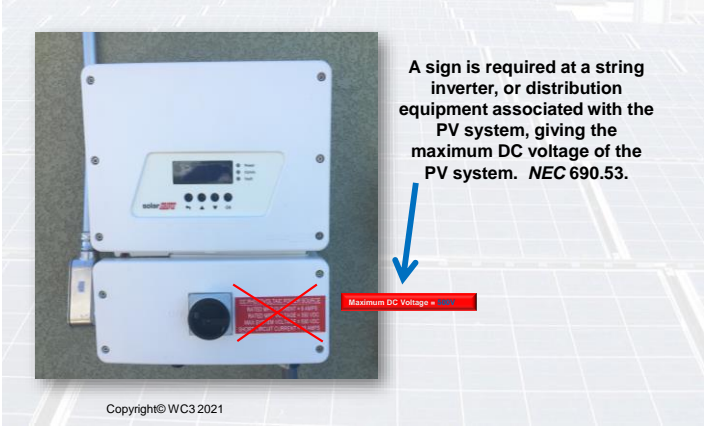
169

Signage at PV Backfed Breakers



170

Sign at String Inverters



171

Wiring Methods

690.31(D)(2) – Markings/Labels:

- There must be provided labels on the exterior of all exposed raceways, enclosures, boxes, and conduit bodies. The wording of the labels must state either of the following: “PHOTOVOLTAIC POWER SOURCE” or “SOLAR PV DC CIRCUIT.”

PHOTOVOLTAIC POWER SOURCE

Or

SOLAR PV DC CIRCUIT

172

External Identification Of DC Wiring



Install by Intermountain Wind and Solar

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External Identification Of DC Wiring



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Warning Signage

NEC 690.13(B):

- ❑ A sign is required at any disconnect or electrical box where both sides of terminals can be energized in the open position and must state:

ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH LINE AND LOAD SIDES MY BE ENERGIZED IN OPEN POSITION.

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AC disconnects



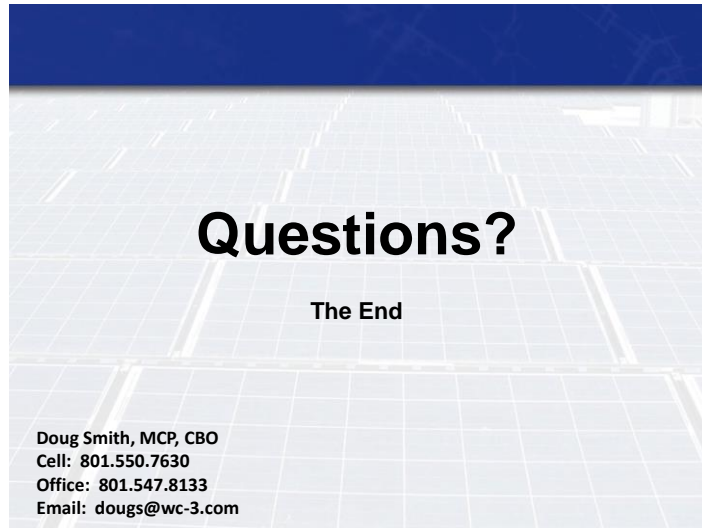
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Here is an example of an AC disconnect switch (used for a PV system) that would require the following sign:

WARNING ELECTRIC SHOCK HAZARD TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION.

NOTE: It's STRONGLY recommended that only AC disconnects with dead-fronts be used for a PV system!

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