# Report of Proposals 2014 NEC

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# PV Industry Forum
# Solar ABCS


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# Understanding the Code

The Code and Electrical Installations Hierarchy:

Chapters 1-4: General information for all installations

Chapters 5-9: Special installations and Equipment

Section 110.3(B): Instructions on listed equipment must be followed

The AHJ has the final say..... But there is always appeal process

UL Standards: Effect the Hardware and the Instructions

# Understanding the Proposals

Know and understand the 2011 NEC

Read the proposals and substantiations and CMP actions in the ROP

Read the comments by CMP members

Note who submitted

Comments may be sent to NFPA or to me for evaluation

See back of NEC for instructions and forms

And here is a brief summary of significant proposals for 690 and 705

The Draft 2014 NEC has errors and text not approved by the CMP

# Definitions 690.3

**DC Combiner: One definition for all types of combiners**

**Multimode Inverter: utility interactive plus stand-alone operation**

**Photovoltaic System: Modules to load**

# 690.4 General Provisions

DC combiners and dc to dc converters must be listed

Conductor installation requirements moved to 690.31

Multiple inverters allowed on a single structure

Comment: Grouping ?

# 690.5 Ground-Fault Protection

**(A) Ground-Fault Detection and Interruption.** The ground-fault protection device or system shall:
(1) Determine the pv input circuit has isolation prior to export of current,

**Comment: Isolation from What?**

# 690.7 Maximum Volatge

(C) One and 2 family dwellings can have 1000 volt systems

Comment: The CMP did not approve this change

# 690.8 Circuit Sizing and Current

**(5) DC-to-DC Converter Output Current .** The maximum current shall be the dc-to-dc converter continuous output current rating.

**690.8 and 690.9 revised to separate conductor calculations from OCPD requirements**

# 690.9 Overcurrent Protection

DC PV circuits require PV Listed Devices

Comment: Not consistent with 690.17(A)(6) and may not be necessary

Current limited sources shall be protected at the source of overcurrent

Comment: Did not make Art 240, but OK here

# 690.11 DC ARC FAULT CIRCUIT PROTECTION

**All arcs (series, parallel and ?) must be detected and interrupted**

**Comment: Ground fault arcs too?**
**This may require module level interruption!**
**Current technical efforts: inverter, combiner, separated detection and interruption**


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# 690.12 PV Emergency Shutdown

PV systems on the roof of buildings shall:

Ten Seconds after emergency shutdown or when PV power source is opened, PV source circuits shall have no more that 80 volts

Comment: PV power source? AC or DC disconnect?

Emergency Shutdown? What is this?—red button?

# III Disconnecting Means

Sections 690.13, 14, and 15 revised for clarity-14 gone/moved

Only Ungrounded dc conductors require disconnects

PV Systems discos have several requirements specified

Comment: PV System discos?? AC or DC or both ?

15(D) DC combiners on roofs must have output circuit load break rated disco inside or within 6 feet


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# III Disconnecting Means (Continued)

690.17(A): Discos permitted to be power operated but must have manual function during power outages

Listed PV devices allowed including “open” type devices

Comment: Not consistent with (C): no contact with live parts

# 690.31-Revised

(A): Guarding of conductors over 30V in RAA now allowed

(B): NO DC PV circuits in raceway with inverter ac circuits

Comment: Misses safety issue and will increase cost

(D): Multiconductor USE-2 and TC-ER allowed on outputs of inverters where fastened every 6 feet

Comment: Not clear if MC USE-2 is available or that TC-ER or USE-2 can be unsupported for 6 feet. Across the roof?

Comment: Circuit routing (structures) still needed but gone

# 690.35 Ungrounded Arrays

**(C):** (1) Determine the pv input circuit has isolation prior to export of current

**Comment: Isolation is not defined**

**(D)(1): Metallic jacketed cable allowed for Source Circuits**

**Comment: Why? Modules cannot accept cables and outdoor rated cable (Deck Cable) is very expensive and not commonly available. All chapter 3 wiring methods with two layers of protection would be allowed.**

# Grounding

690.41: Systems over 300 volts are not to be grounded

Comment: Equipment design and cost impacts going ungrounded

690.46: Solid 6 AWG and smaller EGC and GEC allowed in raceways

690.47(B): AC grounding system permitted for EGC and GFPD on ungrounded DC array

690.47(D): Array grounding for ground or pole mounted arrays.

Comment: Still does not address bonding. Should reference 250.54

# VI Marking

**All Markings and Warnings must comply with new 110.21(B)**
**Colors, permanent, environment**

**690.53(4): PV DC Source will have multiple currents marked**

**690.56(A/B): Comment: Has incorrect reference to 690.31(E)**

**690.56(B): Will have emergency disconnect warning:**

MAXIMUM VOLTAGE AT ARRAY 80VDC AFTER SHUTDOWN

# VIII Storage Batteries

**Entire part and all sections deleted**

**Comment: Many of the PV unique requirements are not found elsewhere in the NEC. Very bad situation. TCC and CMP actions not clear**

# 690 odds and ends

690 Part VII: Raises previous 600 volt break point in PV system to 1000 volts.

Part X: Adds Art 625 EV charging requirements

# 705 Definitions

**705.2 Added Multimode Inverter-same as 690.2**

# 705.12 Point of Connection

**705.12(D)(2): Use 125% of inverter rated current in calculations, instead of inverter output breaker rating.**

"In systems where inverter output connections are made at feeders, any load taps must be sized based on the sum of 125% of the inverter(s) output circuit current and the rating of the overcurrent device protecting the feeder conductors as calculated in 240.21(B)."

**Comment: Appears to allow the use of TAP rules-not clear**


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# 705.12 Point of Connection (Cont)

Conductors have been removed from the calculations
Calculations apply to busbars

705.12(D)(2)(a) : 125% inverter output plus utility OCPD shall not exceed busbar rating—general rule, no restrictions on location or loads

705.12(D)(2)(b): Where sources are at opposite ends of bus bar, the 120% allowance applies. Center fed panels not covered

# 705.12 Point of Connection (Cont)

705.12(D)(2)(c): The utility OCPD protecting a busbar may not exceed the rating of the busbar.

Ignore the utility OCPD. The sum of all load and supply OCPD may not exceed the rating of the busbar

Comment: Use OCPD ratings or 125% of inverter ratings? (D)(2) says use 125% ???

705.12(D)(2)(d): P.E. required where multiple ampacity bus or center fed bus is involved

# PV Industry Forum Items Not Approved

Definitions related to inverters not fully realized

PV systems definitions not fully clarified

Additional work needed on disconnects

DC to DC converters are not being properly addressed

More work needed on 705.12