

# ARTICLE 690

## SOLAR PHOTOVOLTAIC (PV) SYSTEMS

### Introduction to Article 690—Solar Photovoltaic (PV) Systems

You have seen, or maybe own, devices powered by photovoltaic cells, such as night lights, car coolers, and toys. These generally consist of a small solar module powering a small device running on a few volts and a fraction of an ampere. A solar PV system that powers a building or interconnects with an electric utility operates on the same principals but on a much larger scale.

Solar PV systems that provide electrical power to an electrical system are complex. There are many issues that require expert knowledge in electrical, structural, and architectural issues.

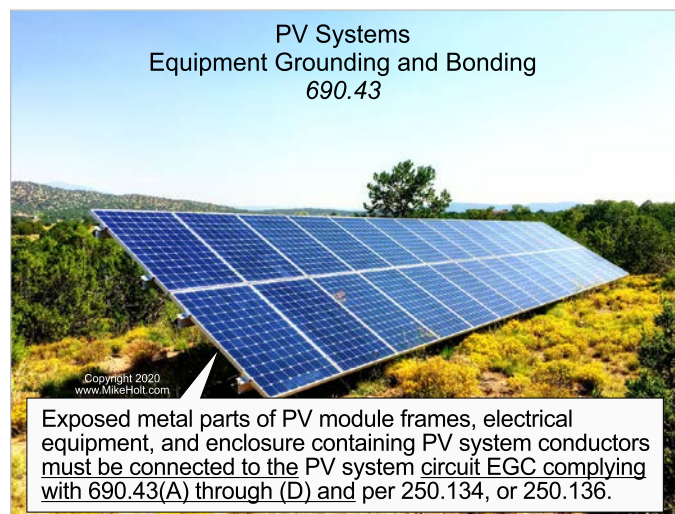
The purpose of the *NEC* is to safeguard persons and property from the hazards arising from the use of electricity [90.1(A)]. Article 690 is focused on the electrical hazards that may arise from installing and operating a PV system. It consists of eight parts.

The general *Code* requirements of Chapters 1 through 4 also apply to these installations, except as specifically modified by this article [90.3].

### Part V. Grounding and Bonding

#### 690.43 Equipment Grounding and Bonding

Exposed metal parts of PV module frames, electrical equipment, and enclosures containing PV system conductors must be connected to the PV system circuit equipment grounding conductor complying with 690.43(A) through (D) and in accordance with 250.134 or 250.136. ▶Figure 690–79



▶Figure 690–79

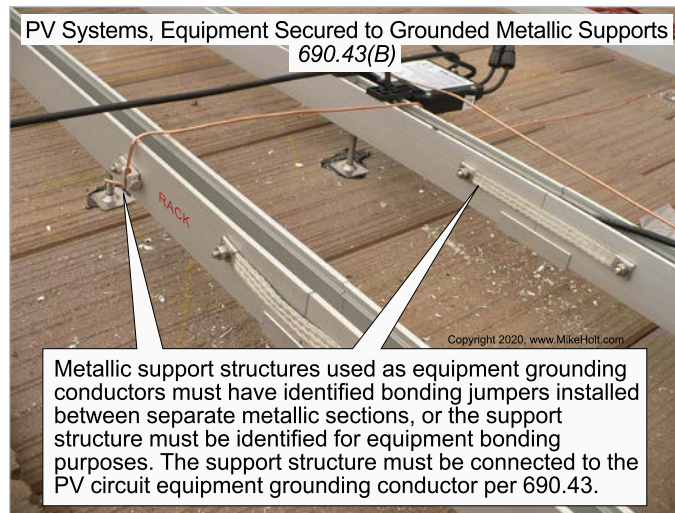
#### Author's Comment:

- ▶ According to 250.134, metal parts of equipment, raceways, and enclosures must be connected to one of the equipment grounding conductor types identified in 250.118. An equipment grounding conductor of the wire type for a dc circuit can be run separately from the circuit conductors when it is within the array [250.134 Ex 2].

**(A) Photovoltaic Module Mounting Systems and Devices.** Devices used to secure and bond PV module frames to metal support structures and adjacent PV modules must be listed, labeled, and identified for bonding. Devices that mount adjacent PV modules are permitted to bond adjacent PV modules.

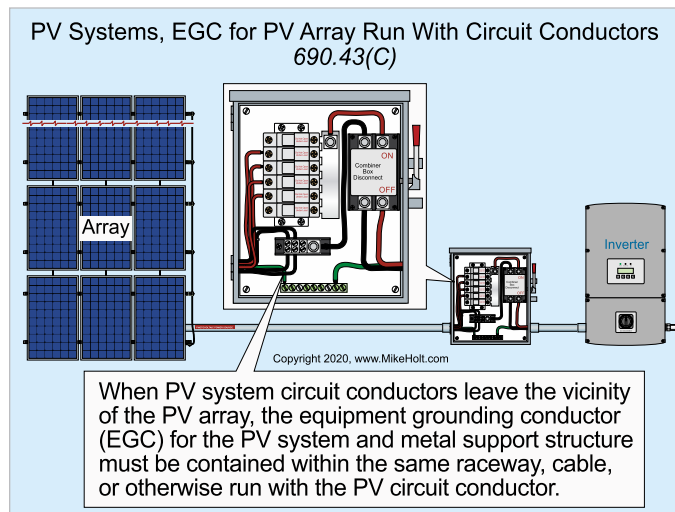
**(B) Equipment Secured to Grounded Metal Support Structure.** Metallic support structures listed, labeled, and identified for bonding and grounding metal parts of PV systems can be used to bond PV equipment to the metal support structure.

Metallic support structures used as equipment grounding conductors must have identified bonding jumpers installed between separate metallic sections of the support structure or the support structure must be identified for equipment bonding purposes. The metallic support structure must be connected to the PV circuit equipment grounding conductor as required by 690.43. ▶Figure 690–80



►Figure 690-80

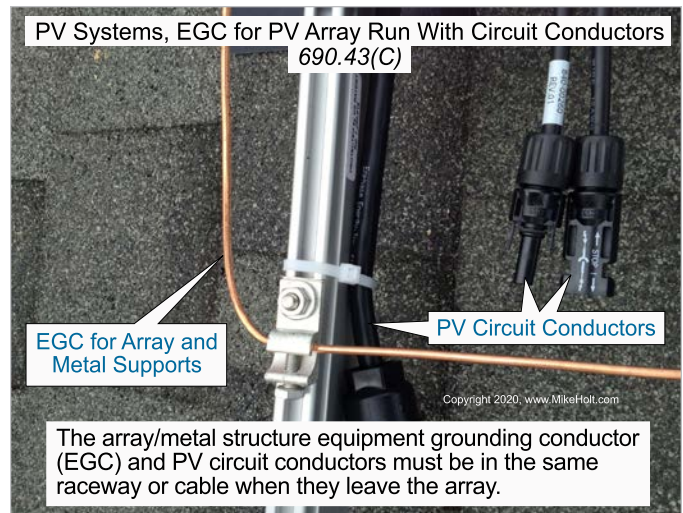
**(C) With Circuit Conductors.** When PV system circuit conductors leave the vicinity of the PV array, the equipment grounding conductors for the PV system and metal support structure must be contained within the same raceway, cable, or otherwise run with the PV circuit conductor. ►Figure 690-81 and ►Figure 690-82



►Figure 690-81

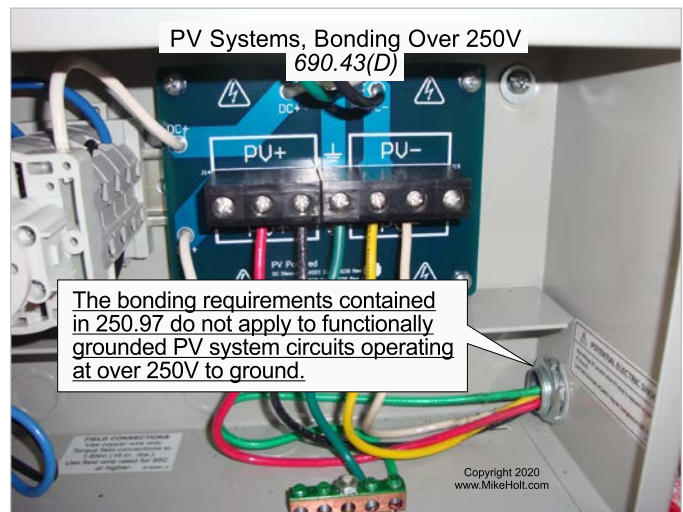
#### Author's Comment:

- Exposed equipment grounding conductors 8 AWG and smaller for dc circuits [250.134 Ex 2] are permitted to be run separately from the circuit conductors where not subject to physical damage [250.120(C)].



►Figure 690-82

**(D) Bonding Over 250V.** The bonding requirements contained in 250.97 do not apply to functionally grounded PV system circuits operating at over 250V to ground. ►Figure 690-83



►Figure 690-83