

**Public Works Department
Building & Safety Division**

Identification Requirements for DC Grounded Conductors in Photovoltaic (Solar) Systems

(Does not apply to transformerless inverter systems or to micro-inverter systems)

The issue of identification of the grounded conductors in a grounded solar photovoltaic system has recently come up due to observations in the field. Apparently, some installers are using conductors with white insulation for the negative (grounded) conductor of the DC side of the system, while others are using red or other colors. Following is a summary of the applicable codes for this issue and a determination of what is to be provided.

CEC 200.7 Use of Insulation of a White or Gray Color or with Three Continuous White Stripes.

*(A) **General.** The following shall be used only for the grounded circuit conductor, unless otherwise permitted in 200.1(B) and (C):*

- (1) A conductor with continuous white or gray covering*
- (2) A conductor with three continuous white stripes on other than green insulation*
- (3) A marking of white or gray color at the termination*

(The exceptions that follow only apply to cable assemblies in special circumstances.)

The DC side of these systems does have a grounded conductor. Depending on the system, this could be either the positive or the negative conductor from the modules. Building & Safety has discovered, through deeper research that the only real code issue here is that you need to use a different insulation color for the grounded conductors of different systems, per CEC 200.6(D):

***(D) Grounded Conductors of Different Systems.** Where grounded conductors of different systems are installed in the same raceway, cable, box, auxiliary gutter, or other type of enclosure, each grounded conductor shall be identified by system. Identification that distinguishes each system grounded conductor shall be permitted by one of the following means:*

- (1) One system grounded conductor shall have an outer covering conforming to 200.6(A) or (B).*
- (2) The grounded conductor(s) of other systems shall have a different outer covering conforming to 200.6(A) or (B) or by an outer covering of white or gray with a readily distinguishable colored stripe other than green running along the insulation.*
- (3) Other and different means of identification as allowed by 200.6(A) or (B) that will distinguish each system grounded conductor. This means of identification shall be permanently posted at each branch-circuit panelboard.*

200.6(A) permits the following (2) methods of identifying grounded conductors less than size 6 AWG:

- (1) Continuous white or gray outer finish*
- (2) Three continuous white stripes on other than green insulation along its entire length*

It is required that you distinguish the DC grounded conductor from the AC grounded conductor (neutral) by using a different color. Since the entire house is using white insulation for the grounded conductor, you must use a different color or stripes on the insulation to distinguish these grounded conductors of the different systems.

Instead of using a typical ungrounded conductor color (blue, red, violet, etc.) you need to use a conductor with either a continuous gray insulation, or by three white stripes on other than green insulation along the whole length of the conductor to distinguish the DC grounded conductor from the AC grounded conductor. This means that using a red or other color conductor for the negative (grounded) DC conductor is not code compliant. The same would apply to a positively grounded system.

THE FOLLOWING INTERPRETATION IS NOW BEING ENFORCED:

In grounded solar photovoltaic systems (transformer topology), the DC grounded conductor shall be provided with gray insulation or by three white stripes on other than green insulation to distinguish it from the grounded conductors in the AC system, per CEC 200.6. Transformerless technology (topology) is an ‘ungrounded system’, which only means that they do not require a DC grounded conductor (equipment ground and grounding electrode conductor is still needed).

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