



## Memorandum

<b>Date:</b>	November 15, 2018
<b>To:</b>	<b>Municipal Building Officials</b>
<b>From:</b>	Joseph V. Cassidy, P.E., State Building Inspector 
<b>Subject:</b>	Supply Side Connection of PV Systems

**There has been much discussion regarding the proper and code compliant method to connect a PV system to the supply side of a service.**

**Here are short answers to supply-side connection of PV systems questions:**

1. The feeders and PV AC disconnect need to be suitable for use as service equipment.
2. The disconnect needs to be readily accessible, but is not required to be located with the service disconnect.
3. All of the PV system equipment must be grounded either by connection to an equipment grounding conductor or bonding to the grounded circuit conductor (neutral).
4. The grounded circuit conductor (neutral) may be bonded to the PV AC disconnect, but is not required to be. Note: If the neutral is bonded at the disconnect, you need to look at the system carefully to make sure a parallel path has not been created.

**Here are the more detailed answers with excerpts from the 2017 NEC:**

**A PV system can be connected to the building electrical system on the supply side of the service disconnecting means.**

**705.12 Point of Connection.** The output of an interconnected electric power source shall be connected as specified in 705.12(A) or (B).

**(A) Supply Side.** An electric power production source shall be permitted to be connected to the supply side of the service disconnecting means as permitted in 230.82(6). The sum of the ratings of all overcurrent devices connected to power production sources shall not exceed the rating of the service.

**230.82 Equipment Connected to the Supply Side of Service Disconnect.** Only the following equipment shall be permitted to be connected to the supply side of the service disconnecting means:

(6) Solar photovoltaic systems, fuel cell systems, wind electric systems, energy storage systems, or interconnected electric power production sources.

**For a PV system connected on the supply side, the feeders and the PV AC disconnect are subject to the fault currents of the service, so they are required to be service rated.**

**690.13 (C) Suitable for Use.** If the PV system is connected to the supply side of the service disconnecting means as permitted in **230.82(6)**, the PV system disconnecting means shall be listed as suitable for use as service equipment.

**The PV AC disconnect must be located in a readily accessible location, but does not need to be grouped with the service disconnect.**

**690.13 – (A) Location.** The PV system disconnecting means shall be installed at a readily accessible location.

**230.72 - (B) Additional Service Disconnecting Means.** The one or more additional service disconnecting means for fire pumps, emergency systems, legally required standby, or optional standby services permitted by **230.2** shall be installed remote from the one to six service disconnecting means for normal service to minimize the possibility of simultaneous interruption of supply.

**230.2 Number of Services.** A building or other structure served shall be supplied by only one service unless permitted in **230.2(A)** through (D).

**(A) Special Conditions.** Additional services shall be permitted to supply the following: (5) Parallel power production systems.

**All equipment that is part of the PV system must be grounded.**

**690.43 Equipment Grounding and Bonding.** Exposed non-current-carrying metal parts of PV module frames, electrical equipment, and conductor enclosures of PV systems shall be grounded in accordance with **250.134** or **250.136(A)**, regardless of voltage. Equipment grounding conductors and devices shall comply with **690.43(A)** through (C).

**...Either by connection to an equipment grounding conductor**

**250.134 Equipment Fastened in Place or Connected by Permanent Wiring Methods (Fixed) – Grounding.** Unless grounded by connection to the grounded circuit conductor as permitted by **250.32**, **250.140**, and **250.142**, non-current-carrying metal parts of equipment, raceways, and other enclosures, if grounded, shall be connected to an equipment grounding conductor by one of the methods specified in **250.134(A)** or (B).

**250.32 - (B) Grounded Systems. (1) Supplied by a Feeder or Branch Circuit.** An equipment grounding conductor, as described in 250.118, shall be run with the supply conductors and be connected to the building or structure disconnecting means and to the grounding electrode(s). The equipment grounding conductor shall be used for grounding or bonding of equipment, structures, or frames required to be grounded or bonded. The equipment grounding conductor shall be sized in accordance with 250.122. Any installed grounded conductor shall not be connected to the equipment grounding conductor or to the grounding electrode(s).

### **...Or by bonding to the grounded circuit conductor (neutral)**

#### **250.142 Use of Grounded Circuit Conductor for Grounding Equipment.**

**(A) Supply-Side Equipment.** A grounded circuit conductor shall be permitted to ground non-current-carrying metal parts of equipment, raceways, and other enclosures at any of the following locations:

- (1) On the supply side or within the enclosure of the ac service disconnecting means
- (2) On the supply side or within the enclosure of the main disconnecting means for separate buildings as provided in 250.32(B)
- (3) On the supply side or within the enclosure of the main disconnecting means or overcurrent devices of a separately derived system where permitted by 250.30(A)(1)

### **Proposed language for the 2020 NEC will include a new section (250.25) clarifying that bonding to the neutral is permitted.**

(Proposed 2020 NEC) **250.25 Grounding Systems Permitted to be Connected on the Supply Side of the Disconnect.** The grounding of systems connected on the supply side of the service disconnect, as permitted in 230.82, that are in enclosures separate from the service equipment enclosure shall comply with (A) or (B).

**(A) Grounded System.** If the utility supply is grounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the requirements of 250.23(A) through (D).

**(B) Ungrounded Systems.** If the utility supply is ungrounded, the grounding of systems permitted to be connected on the supply side of the service disconnect and are installed in one or more separate enclosures from the service equipment enclosure shall comply with the requirements of 250.24(E).

**However, you need to be cautious if the grounded conductor (neutral) is bonded in the PV AC disconnect. You need to look carefully at the installation to insure that a parallel path for fault current has not been created. An example of a parallel path would be metal conduit running between the PV AC disconnect and the service panel/equipment, or an equipment grounding conductor running back to the grounding electrode bus. A parallel path should be corrected in accordance with 250.6.**

**250.6 Objectionable Current.**

**(A) Arrangement to Prevent Objectionable Current.** The grounding of electrical systems, circuit conductors, surge arresters, surge-protective devices, and conductive normally non-current-carrying metal parts of equipment shall be installed and arranged in a manner that will prevent objectionable current.

**(B) Alterations to Stop Objectionable Current.** If the use of multiple grounding connections results in objectionable current and the requirements of 250.4(A)(5) or (B)(4) are met, one or more of the following alterations shall be permitted: (1) Discontinue one or more but not all of such grounding connections.

(2) Change the locations of the grounding connections.

(3) Interrupt the continuity of the conductor or conductive path causing the objectionable current.

(4) Take other suitable remedial and approved action.