



TECHNICAL SERVICES DEPARTMENT

BULLETIN

**No. 103
June 2015**

Photovoltaic (PV) System Wire and Cable Installations

With the increasing availability of newly listed PV Systems, installers are learning how to safely interconnect PV panels and connect the dc power to the ac system. In the process of determining safe installation methods for PV systems, NPFA-70 (National Electrical Code®) Code-Making Panel 4 has allowed alternate methods in Article 690 to the general wiring methods in NEC® Chapters 1 through 4. Installations on residential and commercial buildings can usually follow standard wiring methods after the "combiner box" to the connection with the buildings power system. Ground-mount installations might also be able to use Chapter 1 through 4 wiring methods, but some installations may need to use listed PV Wire as allowed in Article 690.

PV Wire is currently Listed in accordance with UL 4703, Photovoltaic Wire. In general, PV wire is available for use anywhere within a PV system operating at 2000 volts or less, but other Chapter 3 wiring methods may also be acceptable as indicated in NEC Article 690, Part IV.

Listed PV wiring is the option most commonly used by equipment manufacturers as the wiring pre-installed to each array.

NEC® Section 690.31(G) states that where dc photovoltaic source or output circuits from a building-integrated or other photovoltaic system are run inside a building or structure, they shall be contained in metal raceways, Type MC metal-clad cable or metal enclosures from the point of penetration of the building surface or structure to the first readily accessible disconnecting means. Since dimensions for PV wire are not yet included in the NEC, if PV wire is installed in conduit, the conduit must be sized based on the diameter of the conductor as provided by the manufacturer. There are three voltage options for PV wire: 600 volt, 1000 volt and 2000 volt. The 1000 volt and 2000 volt insulation thicknesses are identical, and they are 10 to 15 mils thicker than the 600 volt

insulation thicknesses. Listed Photovoltaic Wire is the only direct burial single conductor option for installations above 600 volts.

PV wire may be insulated with either thermoplastic or thermoset materials. Thermoplastic insulation is limited to 600 volt, and thermoset is available in all three voltage levels. Thermoset insulated PV wiring may be optionally listed for direct burial. It is required to pass a FV-1 flame test, and may optionally be listed to the VW-1 test requirements. Of note is the requirement that all exposed raceways, cable trays, and other wiring methods that contain PV power source conductors must be marked with the words “Photovoltaic Power Source”.

Effective with the 2014 NEC, 690.31(C)(2) states that PV source and output circuit conductors using single conductor PV wire without a “CT” marking are permitted to be installed in cable trays in outdoor locations. The conductors must be supported at not to exceed 12-inch intervals and secured at not less than 4.5 ft. intervals.

Distribution List:

Standards and Conformity Assessment Policy Committee

Codes and Standards Committee

NEMA Technical Services Department

DISCLAIMER

The standards or guidelines presented in a NEMA standards publication are considered technically sound at the time they are approved for publication. They are not a substitute for a product seller's or user's own judgment with respect to the particular product referenced in the standard or guideline, and NEMA does not undertake to guarantee the performance of any individual manufacturer's products by virtue of this standard or guide. Thus, NEMA expressly disclaims any responsibility for damages arising from the use, application, or reliance by others on the information contained in these standards or guidelines.