



TECHNICAL SERVICES DEPARTMENT

BULLETIN

No. 103

June 2015

Revised August 22, 2024

Photovoltaic (PV) System Wire and Cable Installations

With the increasing availability of newly listed PV Systems, installers have many choices available to safely interconnect PV panels and to connect the dc power to the ac system. NFPA-70 (National Electrical Code® or NEC®) Code-Making Panel 4, in Article 690, has allowed alternate wiring methods in addition to the general wiring methods in NEC Chapter 3. Installations on residential and commercial buildings can usually use standard wiring methods after the "combiner box" to the connection with the building's power system. Ground-mount installations might be able to use Chapter 3 wiring methods, however some installations may need to use listed PV Wire as allowed in Article 690.

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

NEC Section 690.31(D) states that where dc circuits from a PV system are run inside a building or structure, they shall be contained in metal raceways/enclosures or shall be Type MC (metal-clad cable). 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 provided by the manufacturer. It should be noted that in NEC Section 690.31(B), conductors carrying ac and dc current are typically required to be separated.

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 PV 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 Volts, and thermoset is available in all three voltage levels. PV Wire may be optionally listed for direct burial. It is required to pass a FV-1/Vertical flame test and may optionally be listed to the FV-2/VW-1 test requirements. All exposed raceways, cable trays, and other wiring methods that contain PV power source conductors must be marked with the words “Photovoltaic Power Source”.

NEC 690.31(C)(2) permits single conductor PV Wire with or without a “CT” marking to be installed in cable trays in outdoor locations. The conductors must be supported at intervals not to exceed 12 inches and secured at intervals not less than 4.5 feet.

Note: All NEC references are based on the 2023 National Electrical Code.

Distribution List:

Standards and Conformity Assessment Policy Committee

Codes and Standards Committee

NEMA Executive Staff

NOTICE AND DISCLAIMER

The information in this publication was considered technically sound by the consensus of persons engaged in the development and approval of the document at the time it was developed. Consensus does not necessarily mean that there is unanimous agreement among every person participating in the development of this document.

NEMA standards and guideline publications, of which the document contained herein is one, are developed through a voluntary consensus standards development process. This process brings together volunteers and/or seeks out the views of persons who have an interest in the topic covered by this publication. While NEMA administers the process and establishes rules to promote fairness in the development of consensus, it does not write the document and it does not independently test, evaluate, or verify the accuracy or completeness of any information or the soundness of any judgments contained in its standards and guideline publications.

NEMA disclaims liability for any personal injury, property, or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, application, or reliance on this document. NEMA disclaims and makes no guaranty or warranty, expressed or implied, as to the accuracy or completeness of any information published herein, and disclaims and makes no warranty that the information in this document will fulfill any of your particular purposes or needs. NEMA does not undertake to guarantee the performance of any individual manufacturer or seller's products or services by virtue of this standard or guide.

In publishing and making this document available, NEMA is not undertaking to render professional or other services for or on behalf of any person or entity, nor is NEMA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. Information and other standards on the topic covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.

NEMA has no power, nor does it undertake to police or enforce compliance with the contents of this document. NEMA does not certify, test, or inspect products, designs, or installations for safety or health purposes. Any certification or other statement of compliance with any health or safety-related information in this document shall not be attributable to NEMA and is solely the responsibility of the certifier or maker of the statement.