by cable ties, straps, hangers, or similar fittings listed and identified for securement and support in outdoor locations. PV wire or cable shall be permitted in all locations where RHW-2 is permitted.

PV systems meeting the requirements of 691.4 shall be permitted to have support and securement intervals as defined in the engineered design.

(c) Exposed cables sized larger than 8 AWG shall be supported and secured at intervals not to exceed 1400 mm (54 in.) by cable ties, straps, hangers, or similar fittings listed and identified for securement and support in outdoor locations.

Most PV modules are designed for a direct series connection by using factory-installed leads and connectors. To accommodate such a connection, use of a single-conductor PV wire or cable or Type USE-2 cable and single-conductor cable listed for PV applications is permitted in PV source circuits. Type USE-2 cables must be marked RHW-2 and sunlight resistant. Cables connected to PV modules are exposed to sunlight, which can result in ultraviolet degradation of the insulation.

Extremely long runs of separated conductors (with loop inductance and distributed capacitance) and the resulting long-time constants in dc circuits can result in improper operation of overcurrent devices. Running both positive and negative conductors of each circuit and the equipment grounding conductor (EGC) as close together as possible also decreases induced currents from nearby lightning strikes. Because PV modules might operate at high temperatures and are installed in outdoor, exposed locations, the use of high-temperature conductors rated for wet locations, such as USE-2 or RHW-2, is often necessary. See 310.15(B)(2) for requirements on the ampacities of conductors in raceways or cables installed on rooftops exposed to sunlight. Single-conductor cables listed and labeled for use in PV applications will be identified as "PV Wire," "PV Cable," "Photovoltaic Wire," or "Photovoltaic Cable."

Δ **(2) Cable Tray.** Single-conductor PV wire or cable of all sizes or distributed generation (DG) cable of all sizes, with or without a cable tray rating, shall be permitted in cable trays installed in outdoor locations, provided that the cables are supported at intervals not to exceed 300 mm (12 in.) and secured at intervals not to exceed 1400 mm (54 in.).

Where installed in uncovered cable trays, ampacity of single-conductor PV wire smaller than 1/0 AWG, the adjustment factors for 1/0 AWG single conductor cable in 392.80(A)(2) shall be permitted to be used.

Where single-conductor PV wire smaller than 1/0 AWG is installed in ladder ventilated trough cable trays, the following shall apply:

(1) All single conductors shall be installed in a single layer.
(2) Conductors that are bound together to comprise each circuit pair shall be permitted to be installed in other than a single layer.
(3) The sum of diameters of all single conductor cables shall not exceed the cable tray width.

(3) Multiconductor Jacketed Cables. Where part of a listed PV assembly, multiconductor jacketed cables shall be installed in accordance with the included instructions. Where not part of a listed assembly, or where not otherwise covered in this *Code*, multiconductor jacketed cables, including DG cable, shall be installed in accordance with the product listing and shall be permitted in PV systems. These cables shall be installed in accordance with the following:

(1) In raceways, where on or in buildings other than rooftops
(2) Where not in raceways, in accordance with the following:

a. Marked sunlight resistant in exposed outdoor locations
b. Protected or guarded, where subject to physical damage
c. Closely follow the surface of support structures
d. Secured at intervals not exceeding 1.8 m (6 ft)
e. Secured within 600 mm (24 in.) of mating connectors or entering enclosures
f. Marked direct burial, where buried in the earth

(4) Flexible Cords and Cables Connected to Tracking PV Arrays. Flexible cords and flexible cables, where connected to moving parts of tracking PV arrays, shall comply with Article 400 and shall be of a type identified as a hard service cord or portable power cable; they shall be suitable for extra-hard usage, listed for outdoor use, water resistant, and sunlight resistant. Allowable ampacities shall be in accordance with 400.5. Stranded copper PV wire shall be permitted to be connected to moving parts of tracking PV arrays in accordance with the minimum number of strands specified in Table 690.31(C)(4).

TABLE 690.31(C)(4) *Minimum PV Wire Strands*

PV Wire AWG	Minimum Strands
18	17
16–10	19
8–4	49
2	130
1 AWG–1000 MCM	259

(5) Flexible, Fine-Stranded Cables. Flexible, fine-stranded cables shall be terminated only with terminals, lugs, devices, or connectors in accordance with 110.14.

Section 110.14 requires connectors and terminals for conductors more finely stranded than Class B and Class C stranding, as shown in Chapter 9, Table 10, to be identified for the specific conductor class or classes.

(6) Small-Conductor Cables. Single-conductor cables listed for outdoor use that are sunlight resistant and moisture resistant in sizes 16 AWG and 18 AWG shall be permitted for module interconnections where such cables meet the ampacity requirements of 400.5. Section 310.14 shall be used to determine the cable ampacity adjustment and correction factors.