Arc fault circuit interruption solution in solar inverters

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2011 NEC Section 690.11 requires detection and interruption of “arching faults resulting from a failure in the intended continuity of a conductor, connection, module, or other system component.” This requirement describes what are commonly called “series” arc-faults and does not include “parallel” arc-faults resulting from a failure in insulation between two conductors.

In a series arc-fault a conductor is interrupted, creating a gap in the conductive path while current is flowing. This creates a spark that ionizes the surrounding air, producing plasma. If the current is sufficiently high, enough plasma is created to keep the current flowing across the gap in the conductive path. The current is now conducted via the plasma and is visible as an electric arc.

1. Unbroken conductor:
   » The flow of current is uninhibited.
2. Damaged conductor (increased resistance):
   » The current density is increased.
   » The temperature of the conductor rises.
   » The conductor melts.

3. Interrupted conductor (failure in continuity):
   » The conductor is destroyed by heat.
   » Plasma is created due to ionization.
   » The current flows in the form of an electric arc.

Arc-faults in PV systems may be the result of faulty components, installation errors, or mechanical damage and aging occurring after installation. Some common examples for arc-fault causes include:
   » Damaged, pinched or abraded conductors.
   » Loose or separated connections or terminations.
   » Cracked or corroded solder joints in modules or other components.

The listing standard for certification of PV AFCI devices is UL Subject 1699B, Photovoltaic (PV) DC Arc-Fault Circuit Protection, which requires PV AFCI devices to behave according to the requirements of 2011 NEC Section 690.11. UL Subject 1699B stipulates that a PV AFCI device must detect an electric arc of 300 W or more, and interrupt it within a maximum time period of two seconds.

SMA Sunny Boy US inverters available with integrated Arc Fault Circuit Interrupter (AFCI) functionality are fully compliant with 2011 NEC Section 690.11 and have been tested and certified to the requirements of UL Subject 1699B. SMA’s AFCI solution fully integrates the arc-fault detection and interruption functionality within the inverter. When an arc-fault is detected the inverter immediately stops operation, interrupting the flow of current across the arc. The inverter displays an error message indicating that an arc-fault has been detected, and also transmits an error message through its remote monitoring communications interfaces. A manual restart process is required to resume system operations. Integrating AFCI functionality within the PV system inverter eliminates the cost and effort of installing additional arc-fault circuit protection components to meet 2011 NEC section 690.11 requirements.

See video or read the technical information document

Take a look at some of these arcs, although they are far bigger than those on your roof----there is
still the very real risk of fire in any arc since arcs generate a great deal of heat.

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