APPENDIX I: Selecting Overcurrent Devices and Conductors in PV Systems

1. Define Continuous Currents

The unique nature of PV power generators dictate that all ac and dc calculated currents are continuous and are based on the worst-case conditions. There are no non-continuous currents and all currents are treated as continuous.

A. DC currents in PV source and PV output circuits are calculated as 125% of the short-circuit current (I_{sc}) (690.8(A)(1)).

B. AC inverter (stand-alone or utility-interactive) output currents are calculated at the rated output of the inverter (690.8(A)(3)).

C. DC inverter input currents from batteries are calculated based on the rated output power of the inverter at the lowest battery voltage that can maintain that output (690.8(A)(4)). Inverter dc to ac efficiency must also be factored into the calculation.

2. Select Overcurrent Device

A. The overcurrent device will be rated at 125% of continuous current (690.8(B)(1)).

1.) If the overcurrent device is in a listed assembly and the combined assembly is listed for 100% duty, then use 100% continuous current to size the overcurrent device (690.8(B)(1) EX)).

2.) The calculated value of the overcurrent device may be rounded up to next standard rating (where the rating is less than or equal to 800A (240.4(B). Standard values of overcurrent devices in PV source and output circuits are 1-15 amps in 1-amp increments (690.9(C)).

In PV source circuits, the value should be less than or equal to the value of the maximum series protective fuse marked on the back of the module. If desired (for unforeseeable reasons), this selected value could be increased to the size of the maximum protective fuse found on the back of the module. However, this will impact conductor sizing and other overcurrent device requirements.

B. If the overcurrent device is exposed to temperatures (operating conditions) greater than 40°C, temperature correction factors must be applied to the device rating (110.3(B)).

3. Select Conductor

A. A conductor should be selected with a 30°C ampacity *not less than* 125% of continuous current (215.2(A)(1)).

B. The conductor selected must have 30°C ampacity after corrections for conditions of use (ambient temperature and conduit fill) *not less than* the continuous currents (no 125% used at this time).

1.) Apply the conductor selection requirements at all points of different temperatures and or conduit fill.

2.) Use the 10%/10-foot rule where appropriate (310.15(A)(2) EX).

C. Select the larger conductor from 3.A. or 3.B (310.15(A)(2)).

4. Evaluate conductor temperature at each termination

A. A current for conductor size selected in 3.C should be selected from Table 310.16 using 60°C or 75°C ampacity columns depending on conductor temperature rating of the device terminals (110.14(C)).

B. If the terminals are in an ambient temperature greater than 30°C, the current found in 4.A. should be derated for the higher temperature using the correction factors at the bottom of the 60°C or 75°C columns as appropriate.

C. The current in 4.B. must *not be less than 125%* of continuous current.

D. Increase the conductor size, if necessary, to meet 4.C at all terminations.

5. Verify that the Overcurrent Device Protects Conductors

A. The rating of the overcurrent device (after any corrections for conditions of use—2.B.) selected in 2 must *not be more than* the ampacity of the conductor selected in 4.C. The ampacity used for the conductor is that found under the conditions of use (3). Rating round up is allowed (240.4(B)).

B. A larger conductor size should be selected if the conductor selected in 4.C is not protected by the overcurrent device.