

PV DESIGN WORKSHEET WITH STANDARD
INVERTER Based on the 2016 CEC

PROJECT ADDRESS: _____ PLAN CHECK# _____

Breaker maximum sizes: #14 – 15A, #12 – 20A, #10 – 30A, #8 – 50A, #6 – 60A, #4 – 80A

Voc _____ Isc _____

Table 310.15 (B) 16 (see Art. 110.14C)

1. MAX PV VOLTAGE AND CURRENT CALCULATIONS:

Wire Size Max Ampacity

- | | | | |
|----|---|-----------|-----------|
| | | 14 | 20 |
| a. | Max PV system voltage (per NEC. 690.7): | 12 | 25 |
| | 1.12 (*1) x Voc x # of modules in series | 10 | 35 |
| | 1.12 x _____ x _____ = _____ volts | 8 | 50 |
| | !!! Sec. 690.7C requires the Max PV voltage to be | 6 | 65 |
| | Less than 600 volts | | |
| | *1 voltage correction factor section 690.7 | | |

b. Max PV current (NEC 690.8)

1.56 x Isc x # of strings in parallel. So, 1.56 x _____ x _____ = _____ amps

(1.25 x 1.25 = 1.56. Required by section 690.8 B 1a and B2a)

2. DC CONDUCTOR AMPACITY CALCULATIONS: (array to combiner box) NEC310.16

- a. Expected wire temp. = _____ (41 deg. C or 105 deg. F. from table 310.15 (B) (2) (a)) ***See rule K**
- b. Temp. correction = .58 (refer to table 310.15 (B) (2) (a)).
- c. # of current carrying conductors = _____
- d. Conduit fill de-rating: .80 (for more than 3 conductors per table 310.15(B)(3)(a)) If 3 or less: use "1"
- e. Circuit conductor size: _____ awg
- f. Circuit conductor ampacity (310.15(B)(16)): _____ amps
- g. Required Circuit conductor ampacity per NEC 690.8 A info note.
 - 1.25 x 1.25 x Isc = _____ amps
 - 1.25 x 1.25 x _____ = _____ amps
- h. Derated ampacity of circuit conductor per CEC 310.15 (B) (2) (a)
 - Temp. corr. (refer to table 310.15 (B) (2) (a)). x conduit fill corr. (per table 310.15(B)(3)(a)) x
 - circuit conductor ampacity (CEC 310.15 (B) (16)) = _____ amps
 - .58 x .80 x _____ = _____ amps

Note: H must be larger than G Yes ___ No ___ (check one)

3. DC CONDUCTOR AMPACITY CALCULATIONS (from combiner box to inverter)

- a. Ambient temp. adjustment, expose conduit (CEC 310.15 (B) (C) (3) + 22 degrees ***See Rule K**
 - Expected wire temp. (C deg.) (CEC table 310.15 (B) (3) (c)): 41 deg. + 22 deg. = 63 deg.
 - Temp. correction per table 310.15 (B) (2) (A): .58
 - # or current carrying conductors: _____

Conduit fill correction (NEC 310.15B.3.a) _____ .80 (for more than 3 conductors per table 310.15(B)(3)(a)) If 3 or less: use "1"

Circuit conductor size: _____ awg

Circuit conductor ampacity: _____ amps

b. Required circuit conductor ampacity (NEC 690.8 A info note).

1.25 x 1.25 x I_{sc} x # of strings in parallel

1.25 x 1.25 x _____ x _____ = _____ amps

c. Derated ampacity of circuit conductor (NEC 310.15 b 2 (A))

Temp. correction (NEC table 310.16) x conduit fill correction (NEC 310.15B.2.a) x circuit conductor ampacity = _____ amps

.87 x _____ x _____ = _____ amps

Note: C must be larger than B Yes ___ No ___ (check one)

4. AC CONDUCTOR AMPACITY CALCULATION: (between inverter and main elect. Panel)

A.

Expected wire temp. (deg. C) = 41 deg. *See Rule K

Temp. correction (NEC 310.15 B 2 (a)) = .87 (no rooftop adjustment if AC conductors are not of roof)

Circuit conductor size= _____ awg

of current carrying conductors = _____

Conduit fill (NEC 310.15 B.3.a) = _____ .80 (for more than 3 conductors per table 310.15(B)(3)(a)) If 3 or less: use "1"

Circuit conductor ampacity = _____ amps

Inverter Model # _____

Inverter maximum AC Output (for 240 V) _____ A

B. (calculation B)

Required conductor ampacity (NEC 690.8 A info note):

1.25 x max. inverter output current=

1.25 x _____ amps = _____ amps

C.

Derated ampacity of circuit conductors (CEC table 310.15 (B) (2) (a)):

Temp. corr. (CEC 310.15 (B) (2) (a)) x conduit fill corr. (per table 310.15(B)(3)(a) x

Circuit conductor ampacity (table 310.15 (B) (16))=

.87 x _____ x _____ = _____ amps

Note: C must be larger B Yes ___ No ___ (check one)

RULES:

A. AC BREAKER: to be no more than the next standard breaker size up from (calculation 4B).

- B. **Bus Rating:** Article 705.12D(2) states that the sum of the ampere ratings of the overcurrent devices in circuits supplying power to a busbar or conductor shall not exceed 120% of the rating of the busbar or conductor.
- C. **Maximum of 18 inches can cantilever beyond the standoff connection**
- D. **AC BREAKER:** to be rated to protect the conductor per table 310.16 and Art 240.4.D/240.6.A-
- E. **CONDUIT(S) SHALL BE PAINTED TO MATCH SURFACE AND SHALL BE INSTALLED MORE THAN ½”(INCHES) ABOVE ROOF SURFACE**
- F. **ALL EQUIPMENT TO BE LISTED FOR THE PURPOSE.**
- G. **Provide SOLAR PANEL COPPER LAY-IN GROUNDING LUG, TIN PLATED, 14-4, STAINLESS STEEL SCREW, SUITABLE FOR DIRECT BURIAL**
- H. **Use #8 bond wire from Service panel to rooftop, then #6 on rooftop where exposed. (NEC 250.120).**
- I. **Prior to the installation of the solar panels, the Contractor shall schedule an anchorage inspection for all standoffs.**
- J. **SMOKE DETECTORS SHALL BE INSTALLED:**
 - a- Centrally located in corridor (or area) leading to sleeping areas, and inside each sleeping room.
 - b On ceiling of upper level in close proximity to the stairway when sleeping areas are on an upper level.
 - c On each floor level and in basement.
 - d In the adjacent room (or area) where the ceiling height exceeds that of the hallway by 24" or more.
 - e Battery operated smoke detector permitted in existing construction.

CARBON MONOXIDE SHALL BE INSTALLED:

- a. Outside of each separate dwelling unit sleeping area in the immediate vicinity of the bedroom(s).
 - b. On every level of a dwelling unit including basements.
 - c. Battery operated carbon monoxide detector permitted in existing construction.
 - d. Where a fuel-burning appliance is located within a bedroom or its attachment bathroom, a carbon monoxide alarm shall be installed within the bedroom.
- K. The ASHRAE (90.1) 2% Temperature should be used for all starting ambient temperatures. This is the temperature that is likely exceeded during 14 hours (not necessarily continuous) over a summer month (June through August). The rooftop temperatures for conduit are then adjusted for rooftop conditions. For example in Ontario the 2% temperature is 37°C or 98.6°F. NEC table 310.15(B)(3)(c) then shows us we need to add 22°C or 40°F to conduit that is placed ½” to 3-1/2” above the roof surface. The rooftop temperature measurement then becomes 59°C or 138.2°F.

Definitions:

Combiner box: used where long runs of wire occur in order to reduce cost of installing many smaller wires.

Junction box: used to change type of wire from “roof cable” to THWN-2