PV ELECTRICAL INSPECTORS CHECKLIST

CODE SECTIONS	CODE ARTICLES/REFERENCE
SITE REQUIREMENTS	
1. **Local Building Permit:** Permits are obtained and displayed as required.	
2. **Array Mounting Information:** Mounting detail drawing includes roof type and age, mounting system, fastener spacing, and penetration weather sealing method**.**	
3. **Site Drawings:** Site drawings include descriptions and locations of major components.	NFPA 1 11.12 FBC 1507.18.1
5. **Installation and Use:** Listed and labeled equipment is installed and used in accordance instructions.	110.3(B)
6. **Modules:** Modules have appropriate markings: Overcurrent protection, Disconnects Means, Photovoltaic Source Circuit and Inverter Output Circuit.	690.6 (A) (B) (C) (D) ; 690.52
7. **Stand-Alone System:** The premises wiring system shall have adequate to meet the requirements of the code. The wiring system must comply with 690.10 (A) – (E).	690.10(A)
OVERCURRENT PROTECTION	**NEC**
1. **Protected Circuits:** PV source circuit, PV output circuit, inverter output circuit, and battery circuit conductors and equipment are protected in accordance with Article 240.	690.9(A); 240
2. **Multiple Power Sources:** Circuits connected to multiple power sources are provided overcurrent protection from each source.	690.9(A)
3. **Ratings**: Overcurrent protection devices are rated for not less than 125% of the maximum currents calculated or determined in 690.8(A).	690.9(B); 240.4;
4. **Transformers:** Overcurrent protection is provided for power transformers in accordance with Section 450.3.	690.9(F); 450.3
5. **Listed for DC**: Overcurrent protection devices in DC circuits are listed for such use and have the appropriate voltage, current, and interrupt ratings.	690.9(C)
VOLTAGE & CURRENT REQUIREMENTS	
1. **Maximum Photovoltaic System Voltage:** The maximum DC PV system source circuit voltage is calculated based on module open-circuit voltage at the lowest expected ambient temperature. Module manufacturer's temperature coefficients are used when available	690.7(A)

2. **1000 V Limit:** Maximum system voltage is **600 V for dwellings**. Other installation with a maximum PV system voltage over 1000 volt shall comply with Article 690. Circuits over 150 V to ground shall be accessible only to qualified persons.	690.7(C); 690.7(D)
3. **Calculation of Maximum Circuit Current:** The maximum current shall be the sum of parallel module rated short-circuit current multiplied by 125%. PV Output Circuit current = shall be the sum of parallel source current.	690.8(A)(1); 690.8(A)(2)
4. **Inverter Output Circuit Current:** Maximum inverter input and output circuit currents are based on inverter ratings.	690.8(A)(3)
5. **Stand-Alone Inverter Input Circuit Current:** The maximum current shall be the continuous inverter input current rating when the inverter is producing rated power at the lowest input voltage.	690.8(A)(4)
6. **DC-TO-DC Converter Output Current:** The maximum current shall be the dc-to-dc converter continuous output current rating. See 690.8 (5) (B)(1)&(2)	690.8(5)
7. **Equipment Maximum Voltage:** Equipment and devices are rated for maximum system voltage at lowest temperature.	690.7; 110.4
WIRING METHODS & CONDUCTUOR SIZING	**NEC**
1. **Wiring Method for Conduit:** PV source- and output-circuit conductors operating at more than 30 V and installed in readily accessible locations are in conduit.	690.31(A)
2. **Single-Conductor Cable:** Conductors have 90°C, sunlight, and wet service resistances. Single conductor type USE-2 and specifically listed and labeled PV wire is permitted in PV source circuits.	690.31(C)(1)
3. **Identification and Grouping:** PV source- and output-circuit conductors are not run together with conductors of other systems.	690.31(B)
4. **Conductor Ampacity:** Conductors are sized for a de-rated ampacity of at least 125% of the maximum currents calculated or determined in 690.8(A). De-rating factors include high ambient temperatures, location on or above rooftops, and number of conductors run together within a conduit or cable.	690.8(B)(1) & (2); 310.15(B)(2); 310.15(B)16
5. **Flexible Cord and Cable:** Flexible cords and cables where used to connect the moving parts of a tracking PV system, shall comply with 400.5.	690.31(E); 400.5
6. **Small Conductors Cable:** Single-conductor cables in sizes 16 AWG and 18 AWG are permitted for module interconnections if they meet the ampacity requirements of 690.8.	690.31(F); 310.15

7. **PV Source Circuit:** Where DC or AC systems are ran inside of a building, they shall be in metal conduit from the point of penetration into the building to the first point of disconnecting means.	690.31(G)
8. **Electrical Connections:** Connectors are listed for the intended use and environment. Screw terminals are tightened to recommended torque. Crimp-on terminals are used with an appropriate crimping tool.	110.14
9. **Access to Boxes:** Junction, pull, and outlet boxes located behind the modules or panels shall be rendered accessible directly by displacing the module or panel.	690.34; 314
10. **Color Codes for Grounded & Grounding conductors:** Grounded conductors are marked white or gray and grounding conductors shall be green, green/yellow, or bare.	310.12
11. **Protection Against Physical Damage:** Cable and conductors where are subject to physical damage shall be protected. .	300.4
12. **Single 120 – Volt Supply:** No multi-wire branch circuits are allowed on stand-alone 120 V inverter output circuit or panels.	690.10(C)
13. **Arc-Fault Circuit Protection (Direct Current):** PV systems with dc source circuit, dc output circuits, or both, operating at a PV system maximum system voltage of 80 volts or greater , shall be protected by a listed (dc) arc-fault circuit interrupter, PV type, or other system components listed to provide equivalent protection.	690.11
14. **Rapid Shutdown of PV System on Buildings:** PV system installed on or in a building shall include a rapid shutdown function that controls specific conductors in accordance with 690.12(1) through (5).	690.12
15. **Identification of Branch Circuits Supplied From DC. System:** For Un-Grounded conductors**.** See 210.5 (C) (2) **(Color Identification: Black. Red, any color with a positive/negative or continues red/black maker line. Grounded or Grounding conductor colors cannot be used!!!).**	210.5(C) (2)
DISCONNECTS	
1. **Building or Other Structures Supplied by PV system:** A means shall be provided to disconnect all ungrounded dc conductors of a PV system.	690.13
2. **Location/Disconnecting of PV Equipment.** Array disconnect is installed at a readily accessible location either on the outside of the building or structure or inside nearest the point of entrance of the system conductor.	690.13(A); 690.15
3. **Marking.** Each PV system disconnect is marked as such, and suitable for the intended use.	690.13(B)
4. **Grouping.** There are no more than six disconnects for each source of power. Disconnects for each power source are grouped together.	690.13(E)

5. **Equipment Disconnects.** Disconnects are provided to disconnect equipment (inverters, batteries, charge controllers from all ungrounded conductors of all power sources.	690.15
6. **Disconnecting Means:** A disconnecting means shall be provided to disconnect a fuse from all sources of supply if the fuse energized from both directions.	690.16(A)
7. **Disconnect Types.** Disconnects open all ungrounded conductors, are readily accessible, externally operated, have ON/OFF indication, and have appropriate interrupt rating. Manually operated switches and circuit breakers may fulfill these requirements.	690.17 (A) (B) (C) (D) (E)
GROUNDING	
1. **Ungrounded PV Power Systems:** Ungrounded systems include disconnects, overcurrent protection, and ground-fault protection. Equipment is listed for use with ungrounded systems.	690.35
2. **Module Connection Arrangement:** Module connections are such that removal of a module does not interrupt a grounded conductor to another PV source circuit.	690.31(J)
3. **Ground-Fault Protection:** Ground fault protection is provided for grounded arrays.	690.5
4. **PV System Grounding:** PV system shall comply with one of the following: Ungrounded system 690.35, Grounded two-wire system 690.5, Grounded bipolar system (center tap) 690.5, All other methods see 250.4(A)	690.41; 250.4(A)
5. **Point of System Grounding Connection:** DC grounding is made at a single point on the PV output circuit.	690.42
6. **Equipment Grounding:** Non-current-carrying metal components are grounded, including module frames, mounting structures, equipment, conduit, and boxes.	690.43
7. **Equipment Grounding Conductors:** Equipment grounding conductors are routed with PV circuit conductors.	690.43 (A) (B) (C) (D) (E) (F)
8. **Size of Equipment Grounding Conductor:** The equipment grounding conductor is sized according to 250.122. If array does not have GFP, the equipment grounding conductor is sized for at least twice the de-rated circuit conductor ampacity.	690.45; 250.122
9. **Grounding Electrode Systems:** The AC system is grounded according to 250.50 through 250.60. The DC system is grounded according to 250.166 or 250.169.	690.47(A); 690.47(B); 250

10. **System with AC and DC Grounding Requirements:** If system includes both AC and DC systems, the grounding electrode systems are bonded together. The bonding conductor is sized for the larger of the AC and DC requirements. Separate DC and AC grounding electrodes are permitted, or both grounding systems may use the premises AC grounding electrode. The grounding electrode conductor is sized to meet both AC and DC grounding requirements.	690.47(C); 250
11. **Additional Auxiliary Electrode for Array Grounding:** Array is grounded with separate grounding electrode system, unless it would be within 6' of premises electrode.	690.47(D)
OTHER SOURCES	**NEC/REFERENCE**
1. **Inverters UL Listed:** Inverter is listed and identified for interactive operation.	690.60, UL1741
2. **Loss of Interactive Equipment:** Interactive inverters will de-energize if utility power is lost.	690.61
3. **Unbalanced Interconnections:** Unbalanced load connection shall be in accordance with 705.100	690.63
4. **Point of Connection.** The output of interactive inverter is connected to either the supply side or the load side of the utility service disconnect. (**Not in meter can as per FPL Net Metering Guidelines FAC-6.065**).	690.64: 705.12
5. **Dedicated Overcurrent and Disconnect:** The source interconnection of one or more inverter installed in one system shall be made at a dedicated circuit breaker or fusible disconnect.	705.12(D) (1)
6. **Bus or Conductor Ampere Rating:** 125% of the inverter output circuit current shall be used in the ampacity calculation for the following: (1) – (3) steps.	705.12(D) (2)
7. **GFCI**: Interconnection is on the line side of all ground-fault protection equipment.	705.32
8. **Suitable for Back-feed:** Circuit breakers used for load-side connections are suitable for such operation.	705.12(D) (4)
BATTERIES & CONTROLERS	
1. **General:** Battery bank is installed in accordance with Article 480.	690.71(A); 480
2. **Dwellings Operating Voltage:** For dwellings, operating voltage is less than 50 V nominal (no more than 24 - 2 V lead- acid cells in-series).	690.71(B)(1)
3. **Guarded of Live Parts:** Battery terminals and other live parts are guarded and adequate working space is provided.	690.71(B)(2); 480.9

4. **Current Limiting:** Current-limiting fuses are installed on battery output circuits.	690.71(C)
5. **Battery Nonconductive Cases and Conductive Racks:** Batteries in banks of greater than 48 V nominal are in non-conductive cases. Conductive racks are permissible, if no materials within 6" from top of battery case. (Requirements do not apply to VRLA batteries.)	690.71(D)
6. **Disconnects of Series Battery Circuits:** Series disconnects are provided for battery strings over 48 V nominal.	690.71(E)
7. **Battery Maintenance Disconnect Means:** A disconnect is provided for the grounded conductor of each string for battery systems over 48 V. Disconnect is accessible only to qualified persons.	690.71(F)
8. **Charge Control (General):** Charge control is used if charge rates are greater than 3% of battery capacity (C/33). Adjustment is accessible only to qualified persons.	690.72(A)
9. **Sole Means of Regulating Charging:** Systems using diversion charge controllers have a secondary independent means for charge control.	690.72(B)(1)
10. **Circuits with DC Diversion Charge Controller & Diversion Loads:** DC diversion load current rating is less than or equal to charge controller rating, load voltage rating is greater than maximum battery bank voltage, and load power rating is at least 150% of the array power rating.	690.72(B)(2).1
11. **PV System Using Utility-Interactive Inverters:** Interactive systems with batteries need not comply with diversion load requirements, but must have a secondary independent means for charge control.	690.72(B)(3).1&2
12. **Battery Interconnection: (A) Flexible Cable:** Battery interconnections are made with #2/0 AWG or larger flexible cables that are listed for hard-service use and identified as moisture-resistant.	690.74(A); 400
LABELS/WARNINGS	
1. **Labels and Markings:** A warning label shall appear on the utility-interactive inverter or be applied by the installer near the ground-fault indicator at a visible location.	690.51
2. **Modules:** PV modules shall be marked with identification of terminal or leads as to polarity, maximum over-current device rating for module protection, and with the following ratings: (1) Open-circuit voltage. (2) Operating voltage.(3) Maximum permissible system voltage.(4) Operating current.(5)Short-circuit current. (6) max-power Maximum power.	690.51

3. **Direct–Current PV Power Source:** PV power source is labeled with maximum power current, maximum power voltage, maximum system voltage, short-circuit current, and maximum rated output current of charge controller (if installed) at the DC disconnect.	690.53
4. **Interactive System Point of Interconnection:** All interactive system point of interconnection with other source shall be marked at an accessible location at the disconnecting means as a power source and with the rated ac output current and the nominal operating ac voltage.	690.54
5. **PV Power System Employing Energy Storage:** BPV power systems employing energy storage shall be marked with the maximum operating voltage, including any equalization voltage and the polarity of the grounding circuit conductor.	690.55
6. **Facilities with Stand-Alone Systems:** Building or structures with PV stand-alone systems shall have a permanent plaque or directory providing the location of all disconnecting means.	690.56(A)
7. **Utility & PV Power Source:** Building or structures with both utility and PV systems shall have a permanent plaque or directory providing the location of all disconnecting means for all source systems	690.56(B)
8. **Single 120 V Supplies:** A stand-alone system supplied by a 120 V inverter includes a label warning against connecting multi-wire branch circuits.	690.10(C)
9. **Markings:** Ungrounded systems include a label warning of a shock hazard.	690.35(F)
10. **Interrupting Rating:** If all terminals of disconnect are energized when open, a label warns as such.	690.17(E)
11. **Marking:** Panels containing overcurrent protection devices supplying power to bus-bar are marked to indicate all sources of supply.	705.12(D) (3)
12. **Back-Fed Breakers:** Back-fed circuit breakers for load-side connections are labeled as inverter output connections with a warning not to relocate.	690.10(E)
13. **All Labels a Markings Shall Be:** Adequately warn of the hazard using effective words and / colors and or / symbols. Be permanently affixed to the equipment or wiring method. Not be hand written. Be of sufficient durability to withstand the environment involved.	110.21(B)
WARNING SIGNAGE MINIMUM HIGHT (3/8")	690.31(G) (4):110.21(B)
14. **Warning. " ELECTRICAL SHOCK HAZARD IF GROUND FAULT IS INDICATED NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED"**	690.5(C)
15. **Warning. "SINGLE 120-VOLT SUPPLY. DO NOT CONNECT MULTIWIRE BRANCH CIRCUIT"**	690.10(C)

16. Warning. "PV SYSTEM DISCONNECT"	690.13(B)
17. Warning. "DO NOT OPEN UNDER LOAD"	690.16(B)
18. Warning. "ELECTRIC SHOCK HAZARD DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND THE LOAD SIDE MAY BE ENERGIZED IN THE OPEN POSITION"	690.17(E)
19. Warning. "PHOTOVOLTAIC POWER SOURCE" See requirements.	690.32(G) (3) & (4)
20. Warning. "ELECTRICAL SHOCK HAZARD. THE DC CONDUCTORS OF THS PHOTOVOLTAIC SYSTEM ARE UNDERGROUND AND MAY BE ENERGIZED"	690.35(F)

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