

 <p>Building Division</p>	<p>PHOTOVOLTAIC INSPECTION</p> <p>City of Palo Alto (CPA) Building Inspection Division 285 Hamilton Ave. Inspection Request: 650 329-2496</p>	<p>Revision Date: 10/11/12</p>
	<p>IVR# 701, 702, 703, 407</p>	<p>General Requirements/Checklist for: Commercial</p> <p>Codes Enforced: 2010 CBC, CEC/NEC Palo Alto Municipal Code (PAMC)</p>
<p>The information provided in this document is general and intended as a guide only. Each project is unique and additional requirements may be enforced as deemed appropriate.</p>		

WARNING

- Failure to complete items below prior to inspection may result in a re-inspection fee.
- **METER REMOVAL AND SERVICE DISCONNECT/RECONNECT ARE TO BE PERFORMED BY UTILITIES PERSONNEL ONLY. CONTRACTORS WHO TAMPER WITH CPA UTILITIES EQUIPMENT WILL BE ISSUED A CITATION. CITATIONS WILL BE ASSESSED AT \$500.00 PER INCIDENT PER PAMC 12.20.010.**

PROJECT INFORMATION

- PERMIT#: _____
- PROJECT ADDRESS: _____
- DATE: _____

PRIOR TO INSTALLATION

PLANS SHALL BE SUBMITTED AND APPROVED

REQUIRED INSPECTIONS

- STRUCTURAL ATTACHMENT
- BONDING AND GROUNDING FOR MICRO INVERTER INSTALLATIONS (IVR# 407)
- ROUGH WIRING/CONDUIT (For conduit within the building walls)
- CPA ELECTIC METER SHOP (650-496-6987)
- FINAL (Systems shall not to be energized prior to this inspection.)

***WE RECOMMEND APPROVED PLANS FOR PV BE PLACED IN A 4" PVC STORAGE TUBE AND SECURED TO WALL NEAR EQUIPMENT AT THE ELECTRICAL EQUIPMENT LOCATION.**

STRUCTURAL ATTACHMENT

- Verify attachment method is per the approved plans.
- The lag screw must have a minimum 2 ½" embedment into rafter.
- Verify framing and load bearings wall are per plans.
- Composition roofing/shingles – Use a sealant under the shingles to adhere the shingles to the flashing.
- Wood shake/shingle – Verify manufacturer's specifications for a larger flashing.
- Verify equipment and conduit locations to address any issues.

GENERAL REQUIREMENTS

- The approved plans, permit and installation instructions shall be on site at time of inspection.
- Field installation shall be per code/plan. Changes shall be submitted to the city for approval prior to inspection.
- Structural attachments must be inspected prior to cover.
- Junction boxes installed under the array and are not readily accessible, the module shall be removed for inspection
- If a new roofing system is going to be installed, a separate roofing permit and inspections are required. See checklist for specific roof being installed. Flashing and counter flashings are required.
- Where dc wiring is installed inside the structure a separate rough inspection must be scheduled at the all trades inspection.
- DC conductors installed inside the structure shall be installed in a metallic raceway. *CEC 690.31 (E)*
- *Dc wires shall be installed in a metallic raceway where the maximum system voltages are greater than 30 volts. *CEC 690.31(A)*
- Where dc conductors are installed underground, conductors shall be buried 18" or more below grade and a warning tape installed 12" above the conduit. Label conduit per the "Sign and Label" requirements.
- Installer shall have ladder on site and set up at time of inspection. The ladder shall be extended 36" above the roof and ladder shall be secured at roof.
- All equipment shall be open and ready for inspection.
- All underground conduits shall be sealed per 2010 CEC 300.5(G) & 230.8. (example: duct seal)

TORQUE REQUIREMENTS

- Contractor to provide a list of torque specification of circuit breakers at time of final inspection.
- Torque all connections per manufacturer's listing. (Electrical contractor to be onsite with torque wrench and torque screwdriver of the audible type. (Ratcheting). (*CEC 110.3 (b)*)

INSPECTION

- ☐ Provide working clearances (36" deep x 30" wide x 6'6' high) *CEC 110.26*

- The inspector shall check existing panel for hot spots or unsafe conditions. If existing panel is found to be unsafe, it may be necessary for the property owner to hire a licensed electrician to make repairs or replace equipment. Repairs/replacement shall happen prior to photovoltaic hook up.
- Verify **green** sticker from utilities is posted on main electrical service. *Call the meter shop at 650-496-6987 to schedule an inspection from the meter shop.*
- Contractor shall be on site with torque wrench and torque screwdriver of the audible type. (Ratcheting)
- Check torque at all connections per manufacturer's specifications at all equipment including module clips and racking system.
- All connections shall be secure.
- All metallic raceways and equipment shall be bonded and electrically continuous.
- Ground bushing is required around remaining pre-punched concentric or eccentric knockouts on the dc side. *CEC 250.97*
- Unused opening shall be closed with protection equivalent to the wall of the enclosure. *CEC 408.7*
- Where dc conductors are installed underground, conductors shall be buried 18" or more below grade and a warning tape installed 12" above the conduit. Label conduit per the "Sign and Label" requirements.
- Supports:** EMT, IMC, and RMC shall be securely fastened in place at least every 10' and within 3' of each outlet box, junction box, device box, cabinet, conduit body or other termination. *CEC Article 342.30 (A), 344.30 (A), 358.30 (A)*
- Negatively grounded systems:** The negative conductor must be white. The positive conductor may be any color other than green or white.
- Positively grounded systems:** The positive conductor must be white. The negative conductor may be any color other than green or white.

DC DISCONNECT

- Must be rated 600 Vdc.
- Where fuses are installed, verify they are rated 600 Vdc and are the same amperage as specified on the approved drawings.
- Label fuse size inside disconnects.
- Array conductors must be connected to the line side input terminals at the top of the main dc disconnect and conductors to inverter input shall be connected to the load side output terminals (bottom) of dc disconnect.
- The equipment grounding lug shall be as specified by the manufacturer. Verify the lug matches the part number as specified on the inside of the door.
- Remove any insulating finish, such as paint, under the equipment grounding lug prior to installation. *CEC 250.12*
- Verify grounding lugs are located where specified by manufacturer.

- Disconnects shall be installed so that the center of the operating handle, at it's highest position, is not more than 6'-7' above the floor or working platform and shall be located in a readily accessible location. CEC 404.8(A)(1)

INVERTER LOCATION

- Ac and dc disconnects shall be located at inverter (CEC 690.14 (a)-(c))
- Verify maximum/minimum height requirements per mfg.
- Verify clear plastic barrier is returned to its original position separating the ac/dc wiring from the communication wires.
- If electrical equipment is located near the gas meter, verify clearances are met. See gas meter standard drawing # std-gd-02 for clearance requirements.
- Verify GEC and EGC are installed at the terminals as marked/specified by the manufacturer.

AC DISCONNECT

- Verify utility ac disconnect is located within sight and within 10 feet of main electrical service. AC disconnect shall be readily accessible with visible-blades, and lockable.
- The equipment grounding lug shall be as specified by the manufacturer. Verify the lug matches the part number as specified on the inside of the door. Verify grounding lugs are located where specified by manufacturer.
- Remove any insulating finish, such as paint, under the equipment grounding lug prior to installation. CEC 250.12
- The top/line side terminals will have circuit from AC load center/main service connected to terminals, bottom/load side terminals will have circuit form inverter connected to these terminals.
- Disconnects shall be installed so that the center of the operating handle, at it's highest position, is not more than 6'-7' above the floor or working platform and shall be located in a readily accessible location. CEC 404.8(A)(1)

MAIN ELECTRIC SERVICE

- The inspector shall check existing panel for hot spots or unsafe conditions. If existing panel is found to be unsafe, it may be necessary for the property owner to hire a licensed electrician to make repairs or replace equipment. Repairs/replacement shall happen prior to photovoltaic hook up.
- Verify utility ac disconnect is located within sight and within 10 feet of main electrical service. Ac disconnect shall be readily accessible with visible-blades, and lockable.
- Verify utility point of interconnection (circuit breaker) is per plan, does not exceed 20% of the bus rating and is installed at the opposite end from the input feeder. CEC 690.64(B)(2) and 690.64(B)(7)
- Circuit breakers shall be of the same manufacturer as the main electrical service.

- When a backfed breaker is the method of utility interconnection, breaker shall not read "line and load"
- Verify existing ac grounding electrode system (ufer or driven ground rod). The connection to the grounding electrode shall remain accessible. (CEC 250.68 (a))
- If there is not an existing ac grounding electrode, pv contractor shall install a second ground rod at the main electrical service per CEC 250.52(5).
- Verify grounding electrode system from inverter to second ground rod then bonded to existing ac grounding electrode or provide grounding electrode conductor directly from inverter to existing grounding electrode with separate attachment.
- Where and existing grounding electrode system is a driven ground rod, an additional ground rod shall be driven. Ground rods shall be a minimum of 6' apart. (CEC 250.56)

PANELBOARD

- Where the system is backfeeding a panelboard, the breaker must be installed at the opposite end from the input feeders or main circuit location. Exception: Where rating of the panelboard is less than the sum of OCPD supplying it. *CEC 690.64(B)(7)*

ROOF TOP INSPECTION

- Conductors shall be protected from physical damage. (e.g. EMT) *CEC 300.3 (B), 691.31 (B)*
- Connectors require the use of a tool to open. *CEC 690.33 (C) Connectors* shall also be marked "Do Not Disconnect Under Load" or "Not for Current Interrupting." *CEC 690.33 (E)(2)*
- Verify photovoltaic source circuit conductor types USE-2 or PV wire. *CEC 690.31 (B)*
- All equipment on the roof requiring servicing shall meet the required clearances of CEC 110.26.
- When a new roof is being installed or where the connections of the supports are going to be covered up, an inspection is required to verify connections.
- Verify roof penetrations are flashed and counter flashed.
- Modules shall be of the same manufacturer per manufacturer's listing.
- Verify grounding lugs, at the module frames, are installed per the module manufacturer's installation instructions. The grounding method must be located at the ground to earth symbol on the module frame.
- Verify bonding means at modules frames is installed per the module installation instructions.
- Surfaces for bonding of metal module frames shall be scratched to get good contact.
- Module wiring shall be properly secured and protected from damage.

- Where three or more strings are being combined, combiner box shall be listed/factory assembled. Fuses, if required, must be rated 600 Vdc.
- An additional electrode is required near the array when the array is more than 6' from the premises wiring electrode. *CEC 690.47 (D)*
- Exposed pressure treated wood is not allowed.

SIGNS AND LABELS

Labels shall be phenolic where exposed to sunlight. Labels required on conduit shall be permanent, weather resistant and suitable for the environment. Labels shall be red background w/white lettering. The following labels must be provided:

Article	Location of Label	Verbiage
690.5(C)	Utility-interactive inverter, battery enclosure	"WARNING: ELECTRIC SHOCK HAZARD IF A GROUND FAULT IS INDICATED, NORMALLY GROUNDED CONDUCTORS MAY BE UNGROUNDED AND ENERGIZED"
690.35(F)	All enclosures with grounded circuits within.	"WARNING: ELECTRIC SHOCK HAZARD. THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED."
690.14(C)(1)	On the main service when DC wiring is run through the building and the DC disconnect is located other than at the main service	DC Disconnect IS LOCATED....
690.14(C)(2)	On the AC and DC disconnects	PHOTOVOLTAIC SYSTEM DC DISCONNECT PHOTOVOLTAIC SYSTEM AC DISCONNECT
690.53	On the DC disconnects	Operating current ____ Operating voltage ____ Maximum system voltage ____ Short circuit current ____
690.54	At interactive points of interconnection, usually the main service	RATED AC OUTPUT CURRENT XXX AMPS NORMAL OPERATING AC VOLTAGE XXX VOLTS
690.56(B)/ 690.14(D)(4), 705.10	At the electrical service and at the photovoltaic inverter if not located at the same location	A directory providing the location of the service disconnecting means and the photovoltaic system disconnecting means
690.17	At the electrical service	"WARNING! ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTHE THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION"
UTILITIES REQUIREMENT	At the main electrical service when a supply side tap is used	"CAUTION! SUPPLY SIDE TAP. OPEN AND LOCK AC PV DISCONNECT BEFORE REMOVING METER"

SFM - GUIDELINES	On conduit, raceways, enclosures, mark every 10', at turns, above/below penetrations	"CAUTION: SOLAR CIRCUIT"
	On the inverter where PV systems are positively grounded	POSITIVE GROUNDED SYSTEM
	Load centers used as PV circuits combiner boxes shall be labeled.	"PHOTOVOLTAIC CIRCUITS ONLY. NO ADDITIONAL CIRCUITS ALLOWED"
690.55	Battery enclosure	MAXIMUM OPERATING VOLTAGE EQUALIZATION VOLTAGE POLARITY OF GROUNDED CONDUCTORS
When approved by the AHJ through NEC load calculations	Main electric service	"MAXIMUM MAIN BREAKER SIZE: XXX AMPS"
690.35(F) (Ungrounded systems)	Junction box, combiner box, disconnect and other energized devices	"WARNING: ELECTRIC SHOCK HAZARD. THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED."