# SOLAR PHOTO-VOLTAIC SYSTEMS FOR COMMERCIAL AND MULTI-FAMILY RESIDENTIAL BUILDINGS SUBMITTAL REQUIREMENTS

## GENERAL

1. Provide 3 sets of plans
2. Attach all manufacturer specification sheets, installation instructions and U.L. listings to the plans
3. All Photo-voltaic systems installed on commercial and multi-family residential buildings to be reviewed and approved by both the City and OCFA

## ROOF PLAN

1. Provide a roof plan projected on a site plan. Show the location and dimensions of all solar voltaic equipment and PV arrays.
2. Detail equipment support connections to roof. Provide a detail for flashing and water proofing at system supports
3. Provide calculations by a licensed professional engineer or architect to verify supporting members are adequate for existing and proposed loads
4. Provide a partial roof framing plan. Show new and existing supporting rafters, beams and headers include rafter size, span, and spacing. Identify roof sheathing and roofing materials
5. Show roof drainage and drain locations demonstrating that roof drainage is maintained.

## FIRE DEPARTMENT ACCESS PATH WAYS AND SMOKE VENTILATION

A roof access points shall be defined as an area that does not require ladders to be placed over openings (i.e., windows, vents, or doors), that are located at strong points of building construction and in locations where ladders will not be obstructed by tree limbs, wires, signs or other overhead obstructions.

1. Fire Department Access

There shall be a minimum six foot wide clear perimeter around the edges of the roof.

Exception: If either axis of the building is 250 feet or less, there shall be a minimum four feet wide clear perimeter around the edges of the roof.

Exception: If the roof configuration is similar to single family dwelling (such as in the case of townhouses, condominiums, or single family attached buildings), the single family residential access and ventilation requirements may be used when approved by the OCFA.

2. Fire Department Access Pathways

Access pathways shall be established in the design of the solar installation. Pathways shall meet the following requirements:

a. Shall be over structural members.

b. Center line axis pathways shall be provided in both axes of the roof. Center line axis pathways shall run on structural members or over the next closest structural member nearest to the center lines of the roof.

c. It shall be in a straight line not less than four feet clear width to skylights and/or ventilation hatches.

d. It shall be in a straight line not less than four feet clear width to roof fire protection standpipe outlets.

e. It shall provide not less than four feet clear width around roof access hatch with at least one pathway not less than 4 feet in clear width to parapet or roof edge.

3. Fire Department Smoke Ventilation

Arrays shall be no greater than 150 by 150 feet in distance in either axis

Smoke ventilation options between array sections shall be either:

a. A pathway eight feet or greater in width

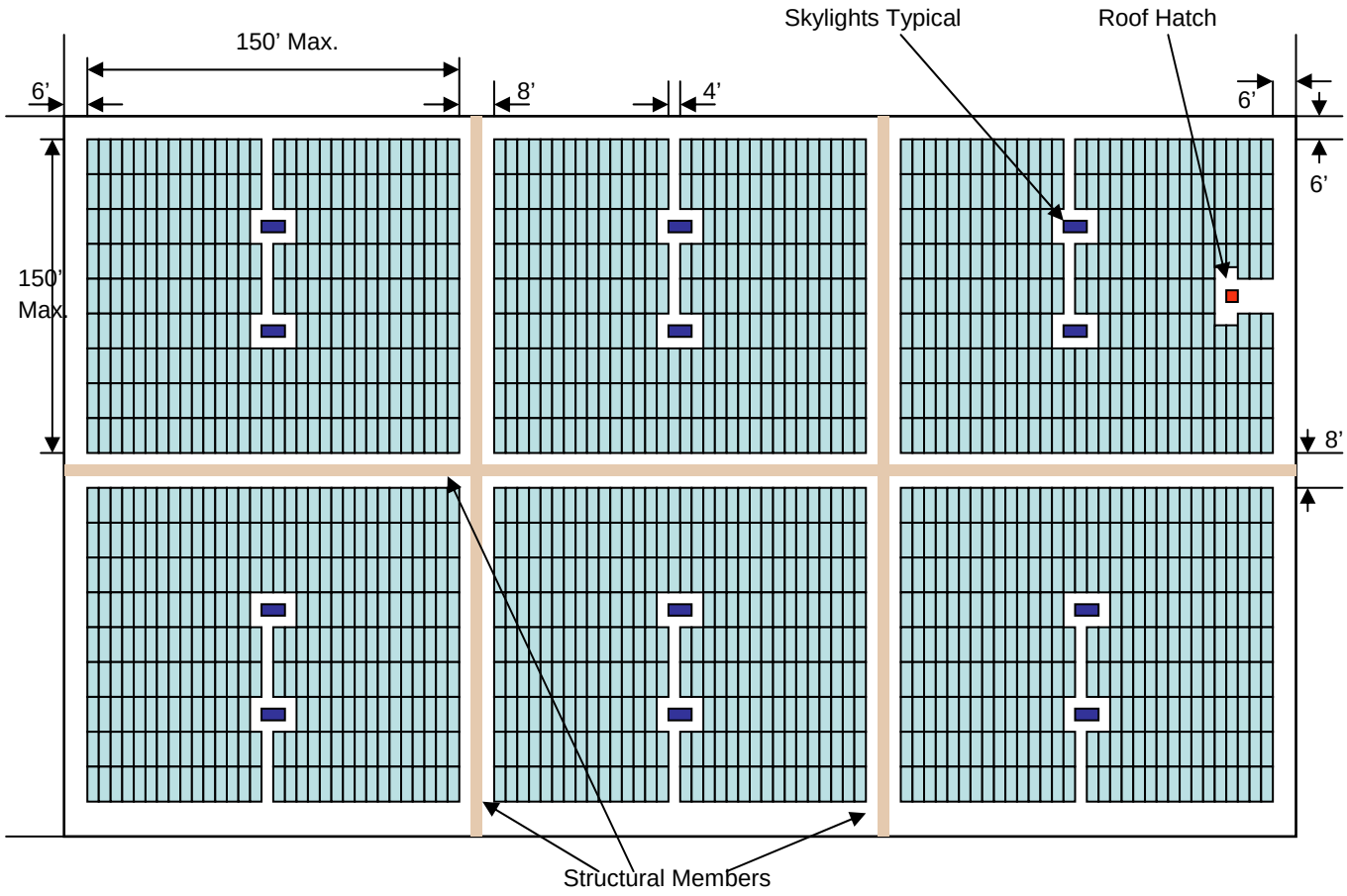
b. Four feet or greater in width pathway and bordering on existing roof skylights or ventilation hatches

c. Four feet or greater in width pathway and bordering 4’ x 8’ “venting cutouts” every 20 feet on alternating sides of the pathway

# EXAMPLE 1 – Large Commercial (Axis > 250’)

## Fire Department Access

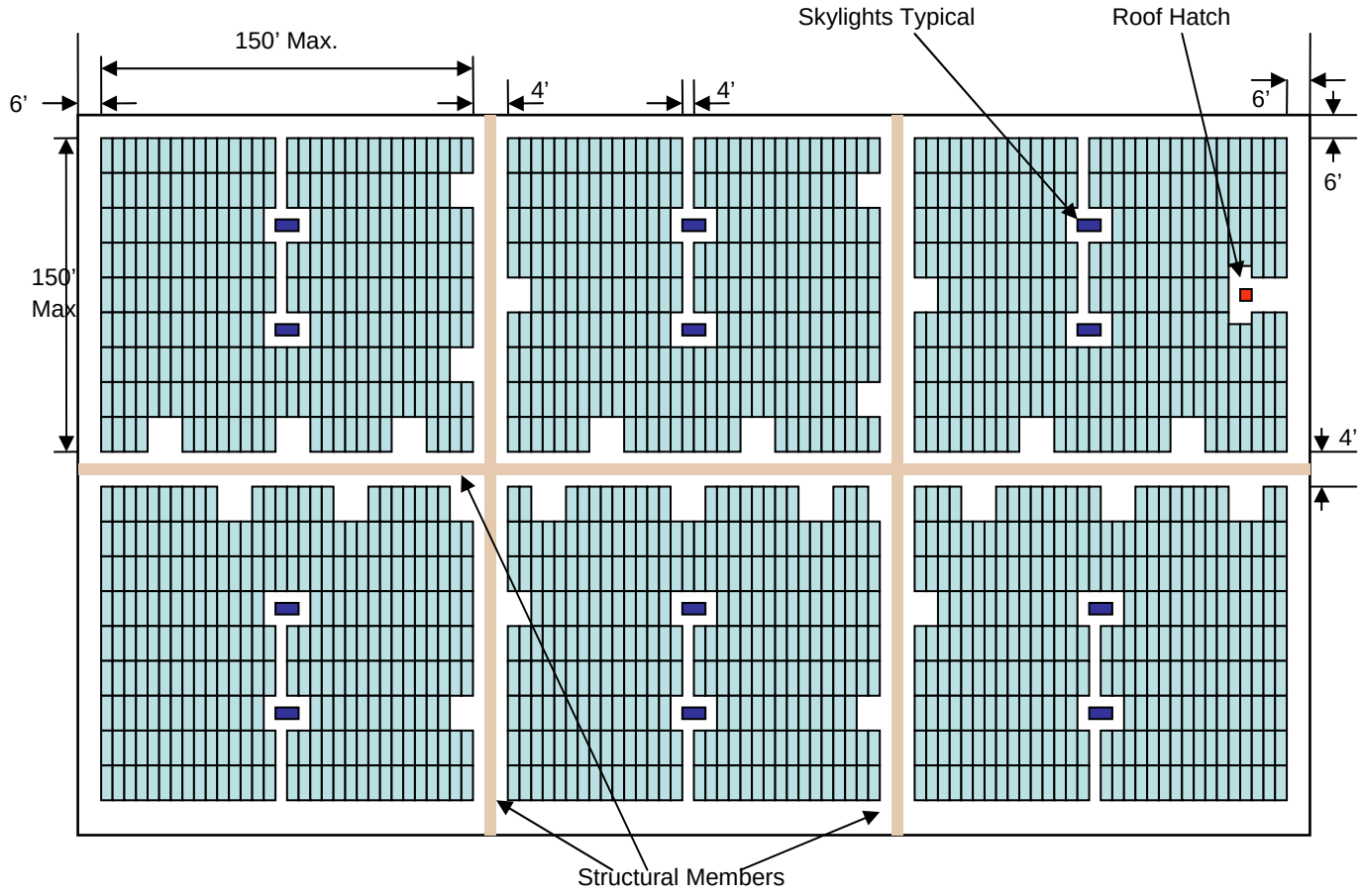
## 8’ Walkways



# EXAMPLE 2 –Large Commercial (Axis > 250’) 4’ Walkways

## Fire Department Access

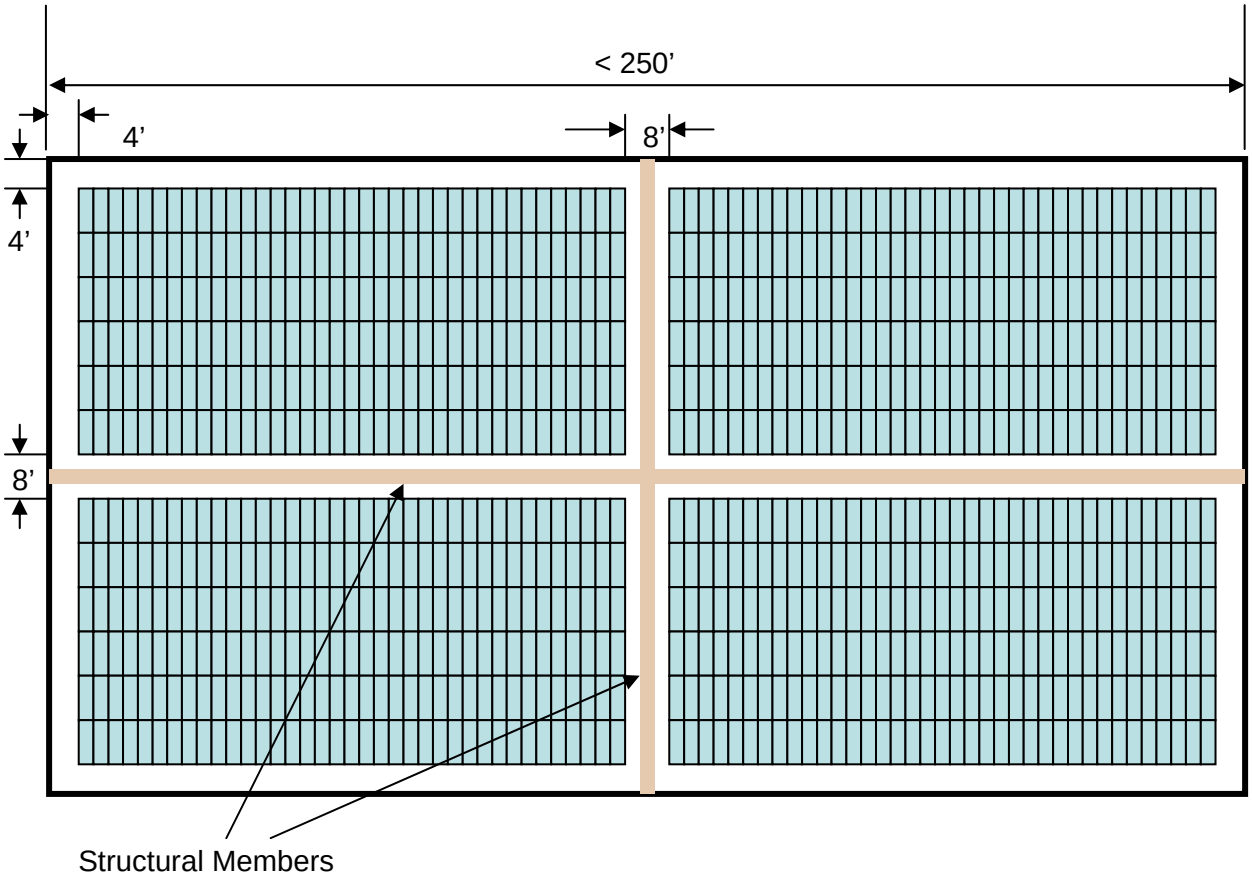
## With 8’ x 4’ Smoke Venting Opportunities Every 20’



# Example 3 - Small Commercial (Axis < 250’)

## Fire Department

## 8’ Walkways

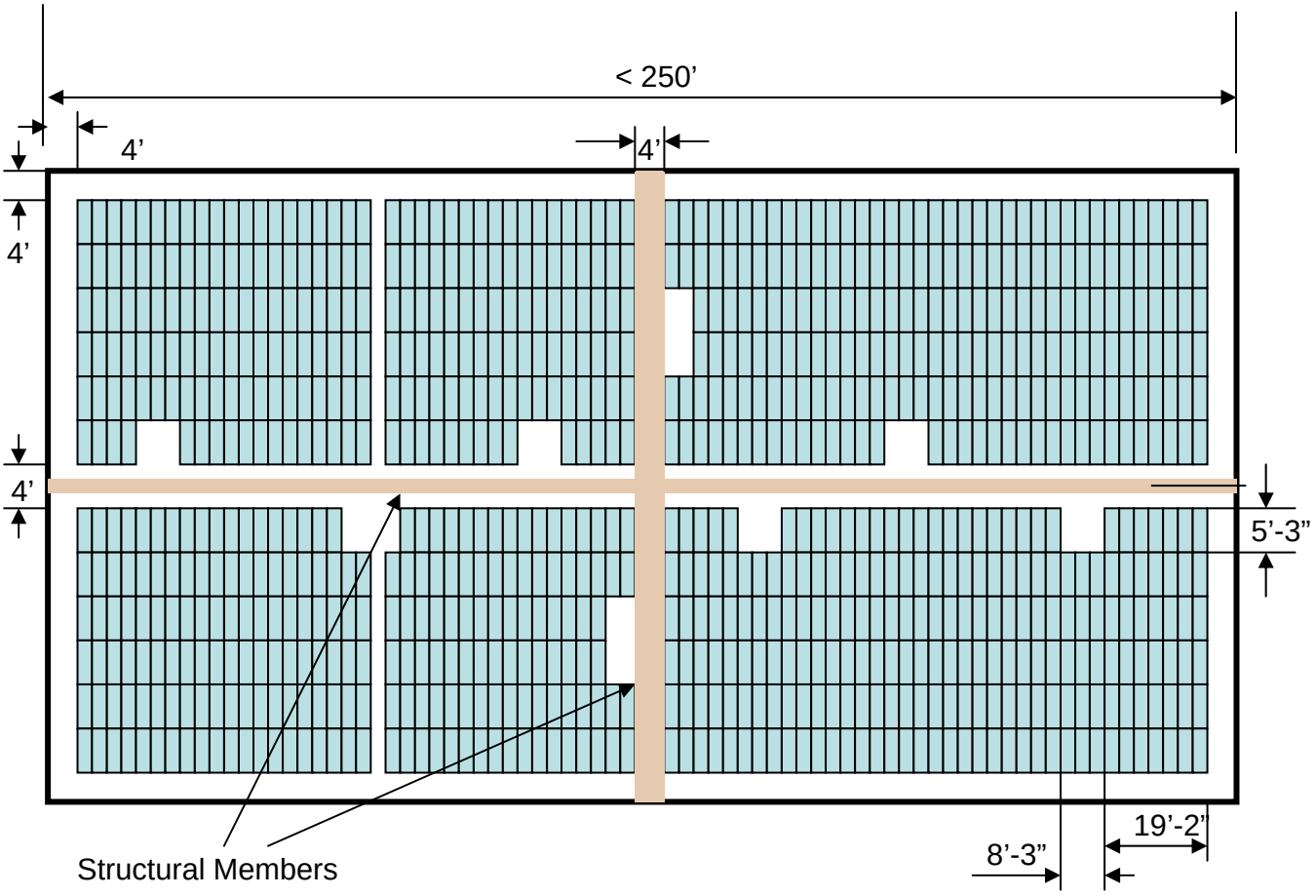


# Example 4 Small Commercial (Axis < 250’) –

# Fire Department Access

# 4’ Walkways

# Smoke Venting Opportunities Every 20’ Along Walkway



## ELECTRICAL

1. Provide Electrical drawings to show compliance with the applicable provisions of the 2010 California Electrical Code.
2. Show the location of the main electrical service, AC/DC disconnects, all solar voltaic equipment, and PV arrays on the roof plan
3. Single Line Diagram: Show array configuration, conduit and conductors sizes with derating calculations
4. Inverter Information: Show model number, maximum D.C. input, maximum A.C. output current. Provide specification cut sheets.
5. PV Module Information: Show open circuit voltage (VOC), short – circuit current (Isc) max series fuse rating. Provide specification cut sheets.
6. Array Information: Show number of modules in series, number of parallel source circuits
7. Wiring and Over Current Protection: Show conductor ampacities, adjusted with all derating factors show rating and location of all Over Current Devices (OCD). Article 690.8(A)&(B).
8. System Labels and Warnings: Show required signage on the plans per 2010 CEC- Article 690
9. Grounding Details: Show equipment ground conductor sized per 2010 CEC Article 690.45. Show ground electrode conductor for inverter at DC side per Article 690.47.
10. Disconnects: Show AC/DC disconnects at inverter. DC disconnect required prior to DC array conductors penetrating the surface of the roof or entering the building
11. System Calculations: Show: (Voc) calculated 1.14 (for City of Irvine per Article 690.7) (Isc) calculated x 125% (NEC 690) x 125% (UL 1703)

## LOCATION OF DC CONDUCTORS

Conduit, wiring systems, and raceways for photovoltaic circuits shall be located as close as possible to the ridge or hip or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities.

Conduit runs between sub arrays and to DC combiner boxes shall use the design that minimizes the total amount of conduit on the roof by taking the shortest path from the array to the DC combiner box. The DC combiner boxes are to be located such that conduit runs are minimized in the pathways between arrays.

To limit the hazard of cutting live conduit in venting operations, DC wiring shall be run in metallic conduit or raceways when located within enclosed spaces in a building and shall be run, to the maximum extent possible, along the bottom of load-bearing members.

## MARKING

PV Systems shall be marked. Marking is needed to provide emergency responders with appropriate warning and guidance with respect to isolating the solar electric system. This can facilitate identifying energized electrical lines that connect the solar panels to the inverter, as these should not be cut when venting for smoke removal.

Materials used for marking shall be weather resistant. UL 969 shall be used as a tandard for weather rating (UL listing of markings is not required).

Marking Format

- Red Background
- White Lettering
- Minimum 3/8” Letter Height
- All capital letters
- Arial or similar font, Non-bold
- Reflective weather resistant material suitable for the environment (durable adhesive materials must meet this requirement)

1. Main Service Disconnect

For residential applications, the marking may be placed within the main service disconnect. If the main service disconnect is operable with the service panel closed, then the marking should be placed on the outside cover.

For commercial application, the marking shall be placed adjacent to the main service disconnect in a location clearly visible from the location where the lever is operated.

- Marking Content: CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED

**CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED**

2. Marking DC Circuit

Marking is required on all interior and exterior DC conduit, raceways, enclosures, cable assemblies, and junction boxes <u>to alert the fire service to avoid cutting them.</u> Marking shall be placed every 10 feet, at turns and above and/or below penetrations, and at all DC combiner and junction boxes.

- Marking Content - CAUTION: SOLAR CIRCUIT

**CAUTION: SOLAR CIRCUIT**

3. Inverters

The inverter is a device used to convert DC electricity from the solar system to AC electricity for use in the building's electrical system or the grid.

No markings are required for the inverter.

4. Remote Disconnect

DC Circuits shall be equipped with a means for remote disconnect located downstream from the photovoltaic array at the point where the circuit enters the structure. Control of the remote disconnect shall be located within five feet of the building's main electrical panel. The remote disconnect shall be listed and meet the requirements of the California Electrical Code

Exceptions:

a. DC Circuits contained in rigid or electrical metallic tubing running between the array combiner box and the main electrical panel which are entirely exterior to the building need not be equipped with a means of remote disconnect other than the disconnects intrinsic to the system.

b. DC Circuits contained in rigid or electrical metallic tubing running between the array combiner box and the main electrical panel that run through the interior of the building when installed a minimum of 18" below the roof assembly when measured parallel to the surface of the roof.

c. The system inverter may be used for remote disconnect when located immediately upstream of the roof penetration where the circuit enters the structure.

Signage shall be located immediately next to the remote disconnect control as follows:

- Marking Content - CAUTION: SOLAR CIRCUIT DISCONNECT

**CAUTION: SOLAR CIRCUIT DISCONNECT**