

CITY OF HEALDSBURG FIRE DEPARTMENT



INSTALLATION STANDARD FOR SOLAR PHOTOVOLTAIC POWER SYSTEMS

**(In partnership with interested local fire officials, building officials,
and industry representatives)**

October 22, 2010

SOLAR PHOTOVOLTAIC INSTALLATION GUIDELINE

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Solar Photovoltaic Power Systems

Solar photovoltaic power systems shall be installed in accordance with this code, the *California Building Code* and the *California Electric Code*.

Exception: Detached Group U non-habitable structures such as parking shade structures, carports, solar trellises, and similar type structures are not subject to the requirements of this section.

1.0 MARKING

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

Materials used for marking must be weather resistant. It is recommended that Underwriters Laboratories Marking and Labeling System 969 (UL 969) be used as standard to determine weather rating. (UL listing of markings is not required).

1.1 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, the marking should be placed on the outside cover.

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

1.1.1 Marking Content and Format

- MARKING CONTENT: CAUTION: SOLAR ELECTRIC SYSTEM
- 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 may meet this requirement)

CAUTION: SOLAR ELECTRIC SYSTEM

1.2 Marking for Direct Current Conduit, Raceways, Enclosures, Cable Assemblies, and Junction Boxes

Marking is required on all interior and exterior conduit, raceways, enclosures, cable assemblies, and junction boxes to alert the Fire Service to avoid cutting them. Marking should be placed on all interior and exterior conduit, raceways, enclosures, and cable assemblies, every 10 feet and within 1 foot of all turns or bends, and above and/or below penetrations and all DC combiner and junction boxes.

1.2.1 Marking Content and Format

- MARKING CONTENT: CAUTION: SOLAR CIRCUIT
- 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 meet this requirement)

CAUTION: SOLAR CIRCUIT

1.3 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.

2.0 ACCESS, PATHWAYS AND SMOKE VENTILATION

Roof access, pathways, and spacing requirements shall be provided in order to ensure access to the roof; provide pathways to specific areas of the roof; provide for smoke ventilation operations; and to provide emergency egress from the roof.

Exceptions:

1. Requirements relating to ridge, hip, and valleys do not apply to roofs slopes of two units vertical in twelve units horizontal (2:12) or less.
2. Residential structures shall be designed so that each array is no greater than 150 feet (45 720 mm) by 150 feet (45 720 mm) in either axis.

3. The fire chief may allow panels/modules to be located up to the ridge when an alternative ventilation method acceptable to the fire chief has been provided or where the fire chief has determined vertical ventilation techniques will not be employed.

2.0.1 Roof Access Points

Roof access points shall be defined as an area that does not place ground ladders over openings such as windows or doors, and are located at strong points of building construction in locations where the access point does not conflict with overhead obstructions such as tree limbs, wires, or signs.

2.1 Residential Systems—Single and Two-Unit Residential Dwellings

Plan review is required if a system is to be installed that will occupy more than 50% of the roof area of a residential building.

Examples of these requirements appear at the end of this guideline.

2.1.1 Access/Pathways

- a. Residential Buildings with hip roof layouts: Modules should be located in a manner that provides one (1) three-foot (3') wide clear access pathway from the eave to the ridge on each roof slope where modules are located. The access pathway shall be located at a structurally strong location on the building capable of supporting the live load of fire fighters accessing the roof.
- b. Residential Buildings with a single ridge: Modules should be located in a manner that provides two (2) three-foot (3') wide access pathways from the eave to the ridge on each roof slope where modules are located.
- c. Hips and Valleys: Modules should be located no closer than one and one half (1.5) feet to a hip or a valley if modules are to be placed on both sides of a hip or valley. If the modules are to be located on only one side of a hip or valley that is of equal length then the modules may be placed directly adjacent to the hip or valley.
- d. Smoke Ventilation: Panels/modules shall be located no higher than three feet (3') below the ridge in order to allow for fire department smoke ventilation operations.

2.2 All Other Occupancies

Access shall be provided in accordance with Sections 2.2.1 through 2.2.3.

Exception: Where it is determined by the fire code official that the roof configuration is similar to a one- or two-family dwelling, the fire code official may

approve the residential access and ventilation requirements provided in 2.1.1 through 2.1.2.

Examples of these requirements appear at the end of this standard.

2.2.1 Access

There should be a minimum six foot (6') wide clear perimeter around the edges of the roof.

Exception: If either axis of the building is 250 feet or less, there should be a minimum four feet (4') wide clear perimeter around the edges of the roof.

2.2.2 Pathways

Pathways should be established in the design of the solar installation. Pathways should meet the following requirements:

- a. The access pathway shall be located at a structurally strong location on the building capable of supporting the live load of fire fighters accessing the roof.
- b. Centerline axis pathways should be provided in both axis of the roof. Centerline axis pathways should run on structural members or over the next closest structural member nearest to the center lines of the roof
- c. Should be straight line not less than 4 feet (4') clear to skylights and/or ventilation hatches
- d. Should be straight line not less than 4 feet (4') clear to roof standpipes
- e. Should provide not less than 4 feet (4') clear around roof access hatch with at least one not less than 4 feet (4') clear pathway to parapet or roof edge

2.2.3 Smoke Ventilation

- a. Arrays should be no greater than 150 by 150 feet in distance in either axis
- b. Ventilation options between array sections should be either:
 1. A pathway 8 feet (8') or greater in width
 2. 4 feet (4') or greater in width pathway **and** bordering on existing roof skylights or ventilation hatches
 3. 4 feet (4') or greater in width pathway **and** bordering four feet (4') x 8 feet 8' "venting cutouts" every 20 feet (20') on alternating sides of the pathway

3.0 LOCATION OF DIRECT CURRENT (DC) CONDUCTORS

Conduit, wiring systems, and raceways for photovoltaic circuits should 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 should use design guidelines that minimize 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 should be run in metallic conduit or raceways when located within enclosed specs in a building and should be run, to the maximum extent possible, along the bottom of load-bearing members.

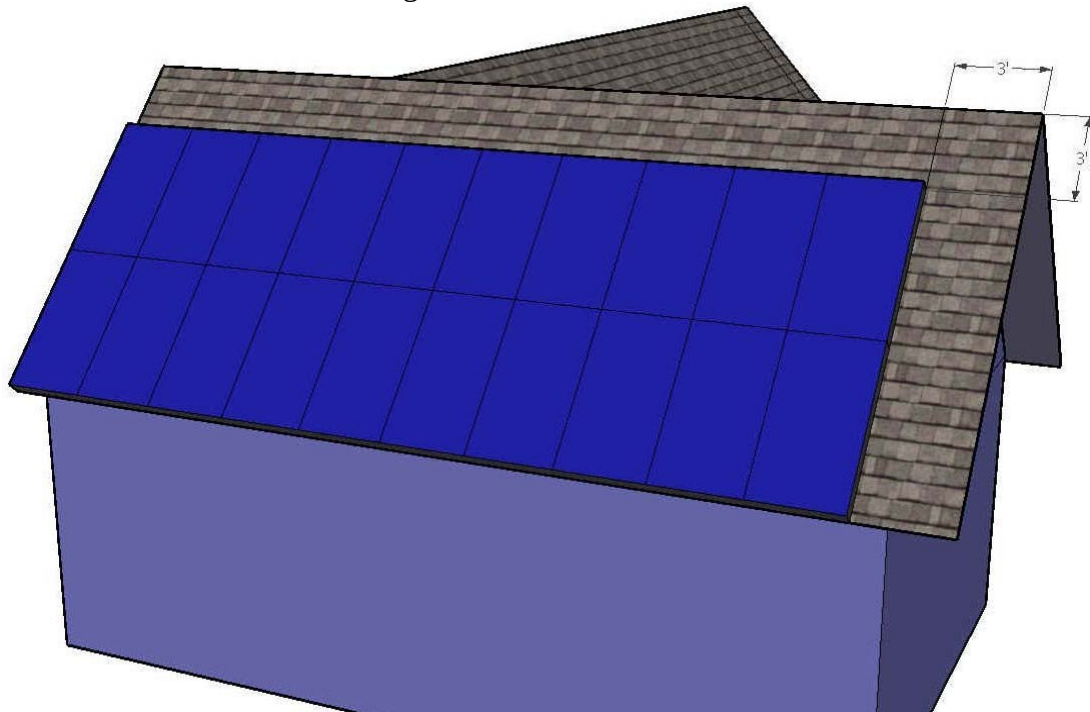
4.0 GROUND MOUNTED PHOTOVOLTAIC ARRAYS

Setback requirements do not apply to ground-mounted, freestanding photovoltaic arrays. A clear brush area of ten feet (10') is required for ground mounted photovoltaic arrays.

*****SEE PAGES 8 – 13 FOR EXAMPLES*****

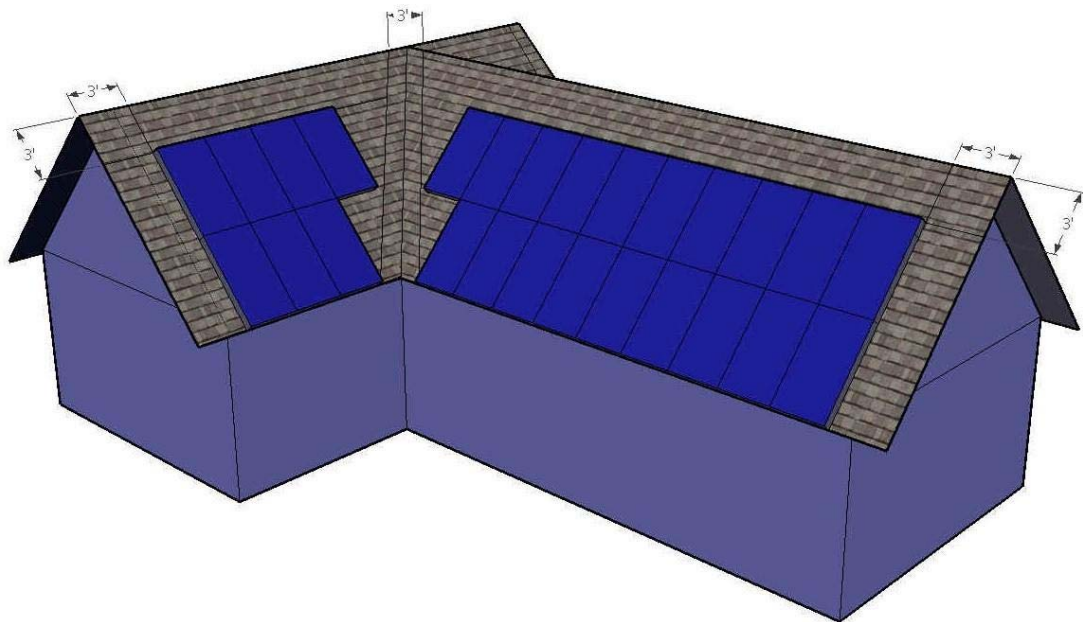
EXAMPLE 1

Diagram 1: Cross Gable Roof



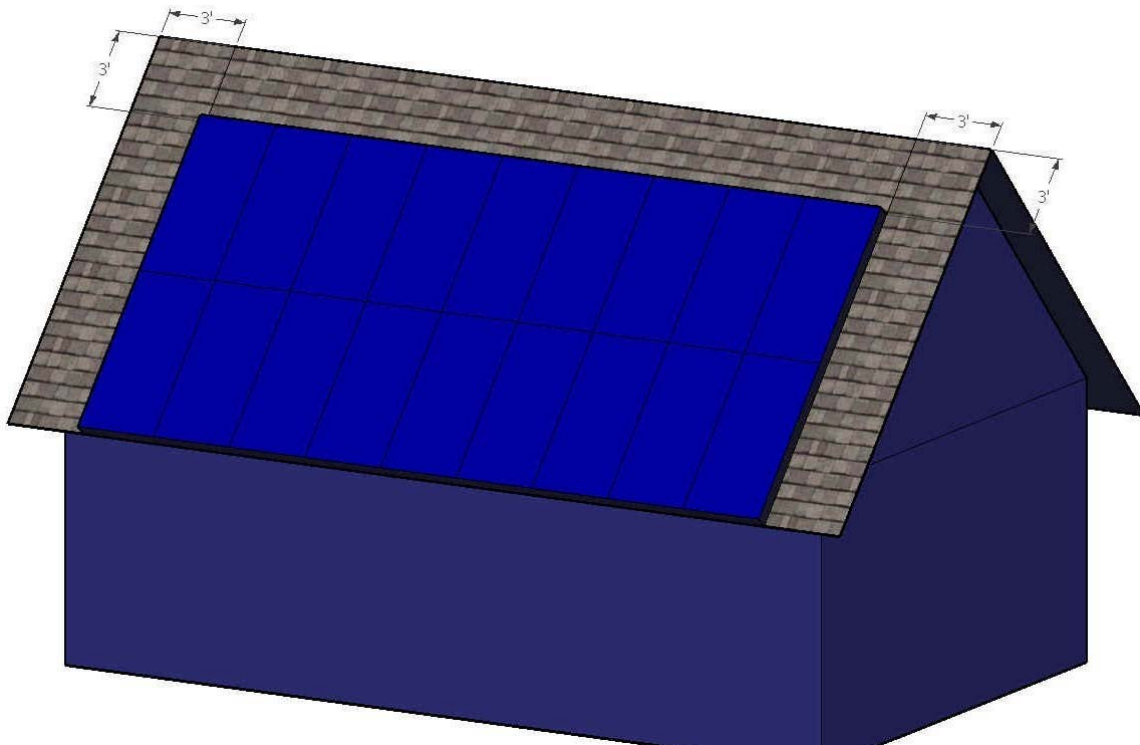
EXAMPLE 2

Diagram 2: Cross Gable with Valley



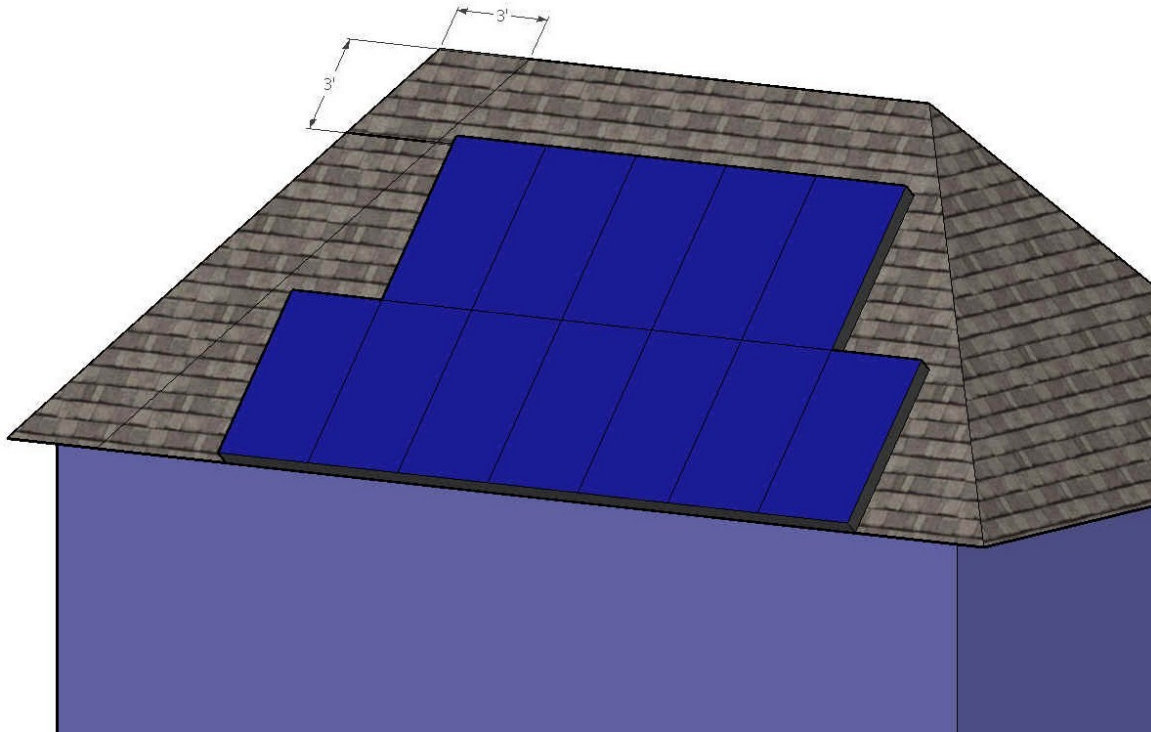
EXAMPLE 3

Diagram 3: Full Gable



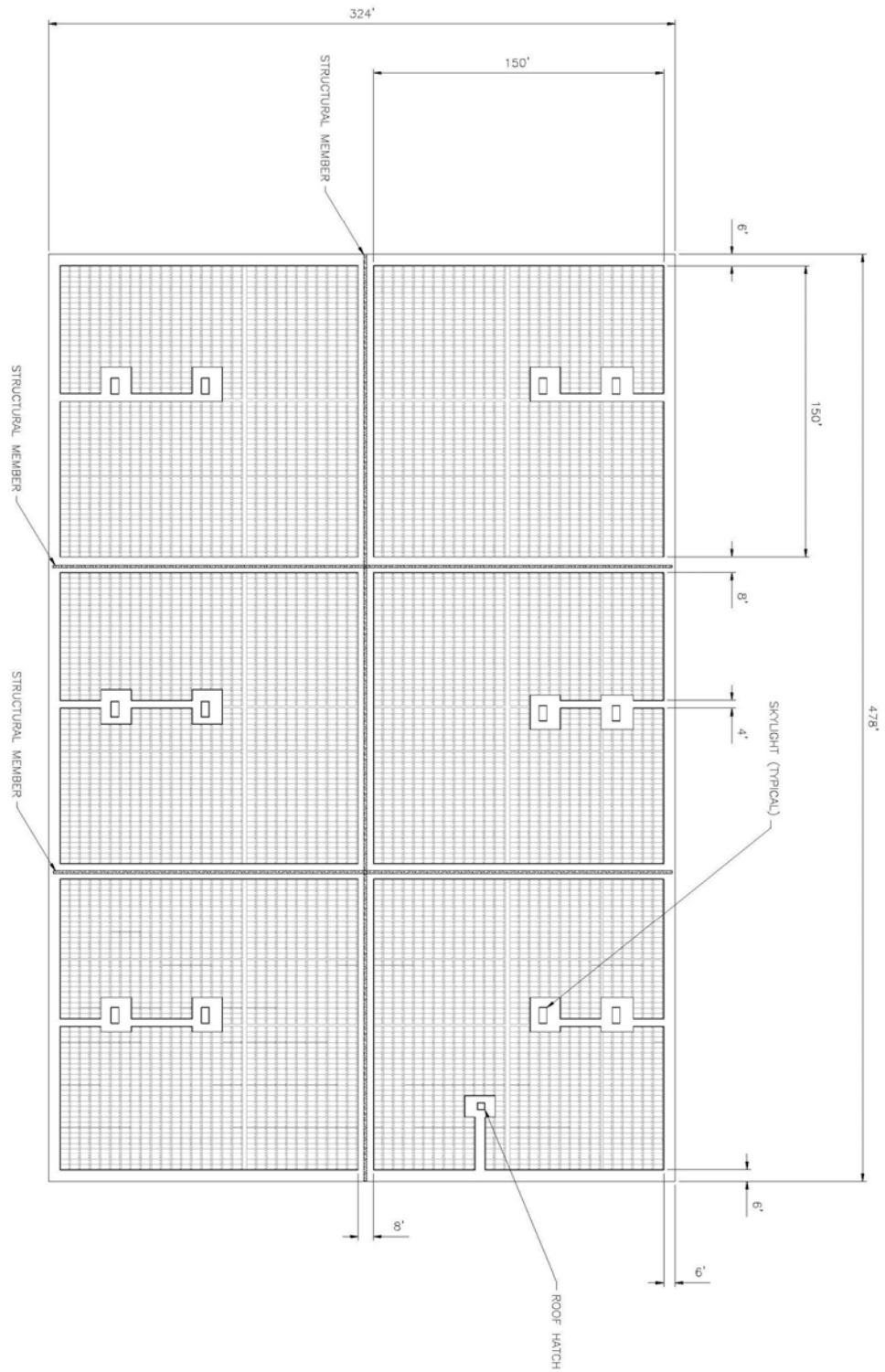
EXAMPLE 4

Example 4: Full Hip Roof

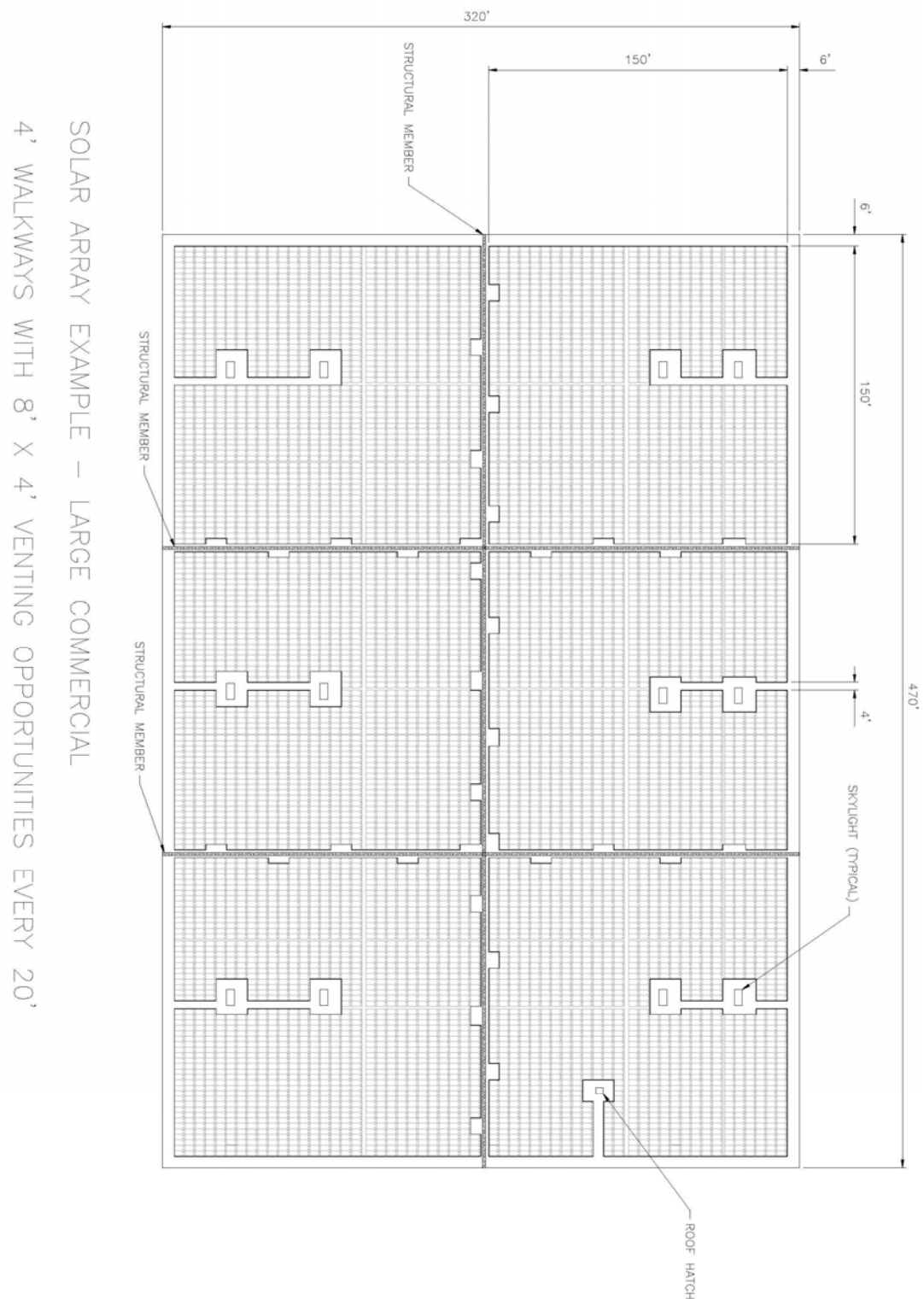


EXAMPLE 5

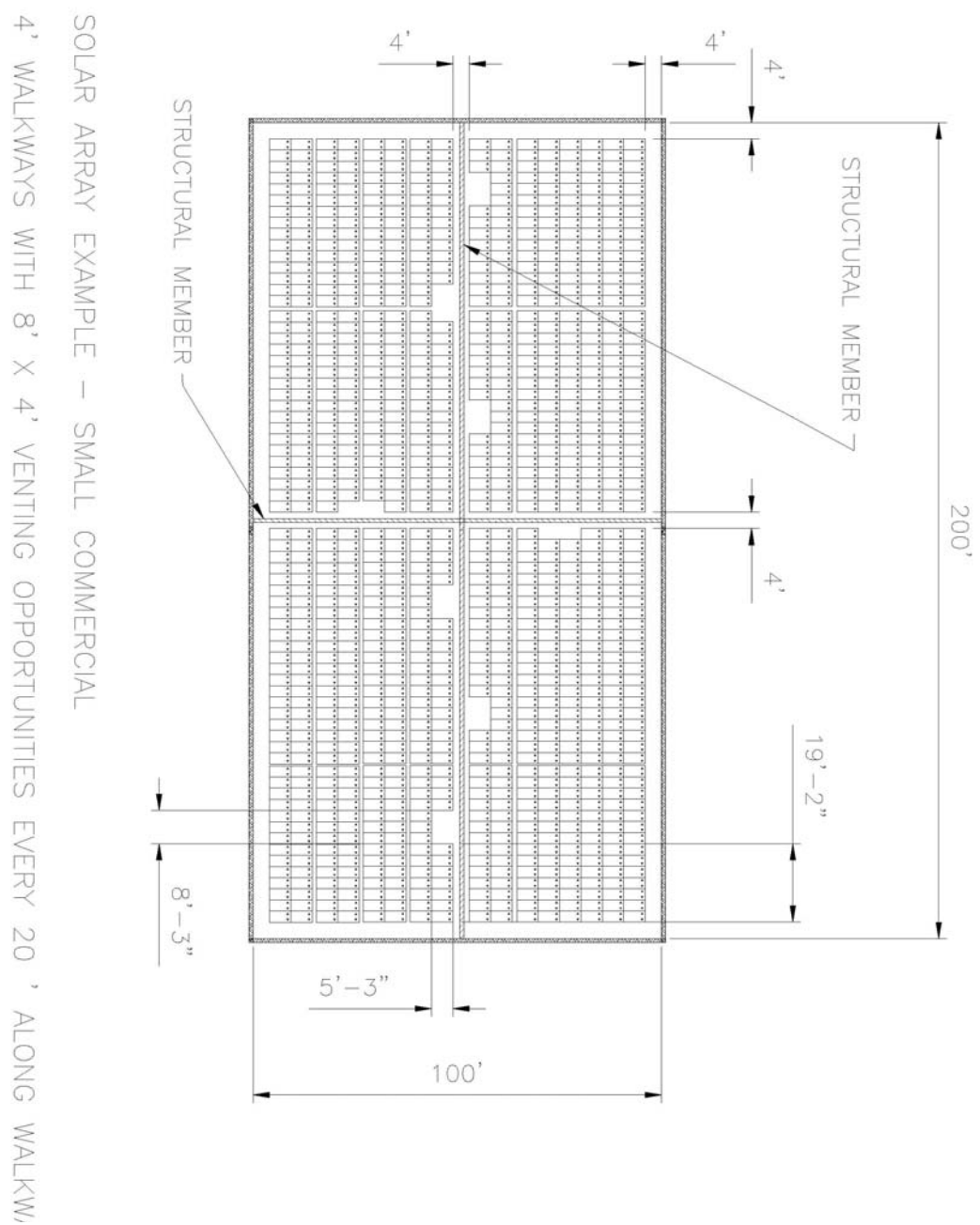
SOLAR ARRAY EXAMPLE – LARGE COMMERCIAL
8' WALKWAYS



EXAMPLE 6



EXAMPLE 7



EXAMPLE 8

SOLAR ARRAY EXAMPLE – SMALL COMMERCIAL
8' WALKWAYS

