



Clovis Fire Department

Standard #48

SOLAR PHOTOVOLTAIC INSTALLATIONS

INSTALLATION STANDARDS

Local Fire Departments and the solar photovoltaic industry have developed this standard for installations to ensure public safety for all structures equipped with solar photovoltaic systems.

This standard was developed with safety as the principal objective. The solar photovoltaic industry has been presented with certain limitations in roof installations due to firefighting suppression techniques. The intent of this standard is to provide the solar photovoltaic industry with information that will allow it to design, build, and install solar photovoltaic systems in a manner that meets the objectives of both the solar photovoltaic industry and the Fire Service.

The provision of this standard by local ordinance shall apply to the design, construction and installation of solar photovoltaic systems on buildings regulated by Title 24 the California Building Standards Codes.

If a solar photovoltaic system design does not meet the provisions in this standard the solar contractor should contact their local fire department to determine if alternate means or methods would allow for a safe installation that is acceptable to the fire department. For residential systems using modules mounted integrally with the roof of the building the modules are tested to and meet the requirements of ICC-ES AC365, Section 3.5 (Penetration Test).

GENERAL

As new products and methods become available, local fire departments may encounter solar photovoltaic systems that will require an alternative means of compliance. Solar contractors shall contact their local fire department to determine if alternate means or methods would allow for a safe installation that is acceptable to the fire department.

Authorities having jurisdiction alternative have means of compliance based on their authority HCD regulations 111.2.4 and 108.7. For example, if new products, designs, technologies or methods become available that provides sufficient alternative protection and access, pathways and ventilation opportunities for fire crews.

MARKING

Marking is needed to provide emergency responders with appropriate warning and guidance with respect to isolating the solar electric system. Materials used for marking shall be weather resistant. Use UL 969 as standard to weather rating (UL listing of markings is not required).

DC Roof Top Disconnects – There shall be a separate emergency DC Disconnect on the roof to disconnect solar panels from DC wiring running through and on the building to the Inverter.

This disconnect must be permanently labeled in reflective, fade-resistant material (see *Marking below*) that states “Emergency DC Disconnect”. This provides a safety mechanism for firefighting ensuring that power has been disabled as close to the source as possible.

Disconnects (NEMA 3R) box shall be installed as close to the array as possible to eliminate any substantial length of energizing wiring that can not be shut down.

Commercial installation where multiple disconnects would be required will be evaluated on a case by case basis.

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 and Format

- Marking Content: CAUTION: SOLAR ELECTRIC CONNECTED
- 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 ELECTRIC SYSTEM CONNECTED

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

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 (durable adhesive materials meet this requirement).

CAUTION: SOLAR CIRCUIT

ACCESS, PATHWAYS AND SMOKE VENTILATION

Access and spacing requirements shall be observed in order to:

- Ensure access to the roof
- Provide pathways to specific areas of the roof
- Provide for smoke ventilation opportunities areas
- Provide emergency egress from the roof

Local jurisdictions may create exceptions to this requirement where access, pathway or ventilation requirements are reduced due to:

- Automatic ventilation device.
- Proximity and type of adjacent exposures
- Alternative access opportunities (as from adjoining roofs)
- Ground level access to the roof area in question
- Adequate ventilation opportunities beneath solar array (as with significantly elevated or widely-spaced arrays)
- Adequate ventilation opportunities afforded by module set back from other rooftop equipment (shading or structural constraints may leave significant areas open for ventilation near HVAC equipment, for example.)
- New technology, methods, or other innovations that ensure adequate fire department access, pathways and ventilation opportunities.

Designation of ridge, hip, and valley does not apply to roofs with 2-in-12 or less pitch. All roof dimensions measured to centerlines.

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

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.

Access

- a) *Residential Buildings with hip roof layouts.* Modules shall 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 (such as a bearing wall).
- b) *Residential Buildings with a single ridge.* Modules shall be located in a manner that provides two (2) three-foot (3') wide access pathways from the eave to the ridge on each roof slopes where modules are located.

- c) *Hips and Valleys.* Modules shall be located no closer than one and one half feet (1½') 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.

Ventilation

Modules shall be located no higher than three feet (3') below the ridge.

Commercial Buildings and Residential Housing comprised of three (3) or more units.

Exception: If a local fire department determines that the roof configuration is similar to residential (such as in the case of townhouses, condominiums, or single family attached buildings), the local fire department may make a determination to apply the residential access and ventilation requirements.

Access

There shall 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 shall be a minimum four feet (4') wide clear perimeter around the edges of the roof.

LOCATION OF 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 shall use design standards 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.

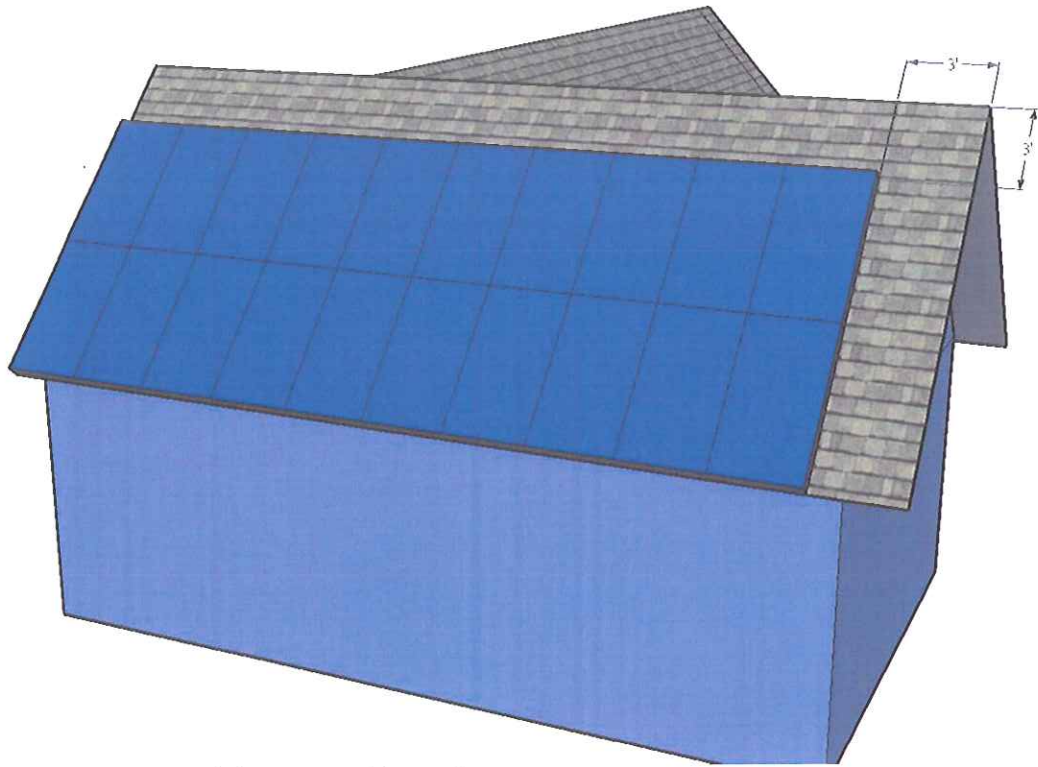
To limit the hazard of cutting live conduit in venting operations, DC wiring shall be run in metallic conduit or raceways when located within enclosed spaces in a building and shall be run, to the maximum extent possible, along the bottom of load-bearing members.

NON-HABITABLE BUILDINGS

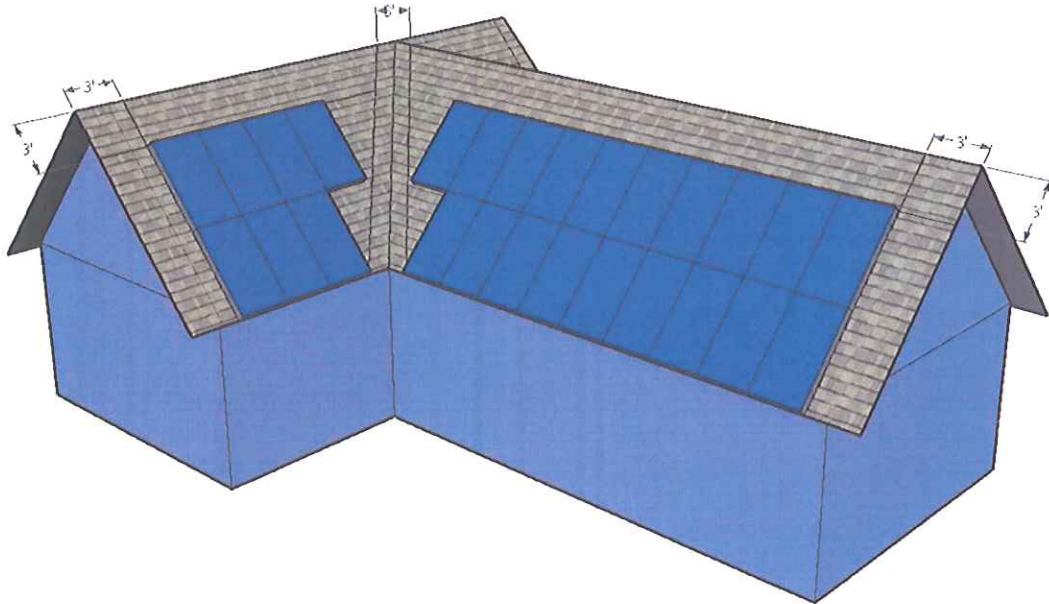
This standard does not apply to non-habitable structures. Examples of non-habitable structures include, but are not limited to, parking shade structures, solar trellises, etc.

GROUND MOUNTED PHOTOVOLTAIC ARRAYS

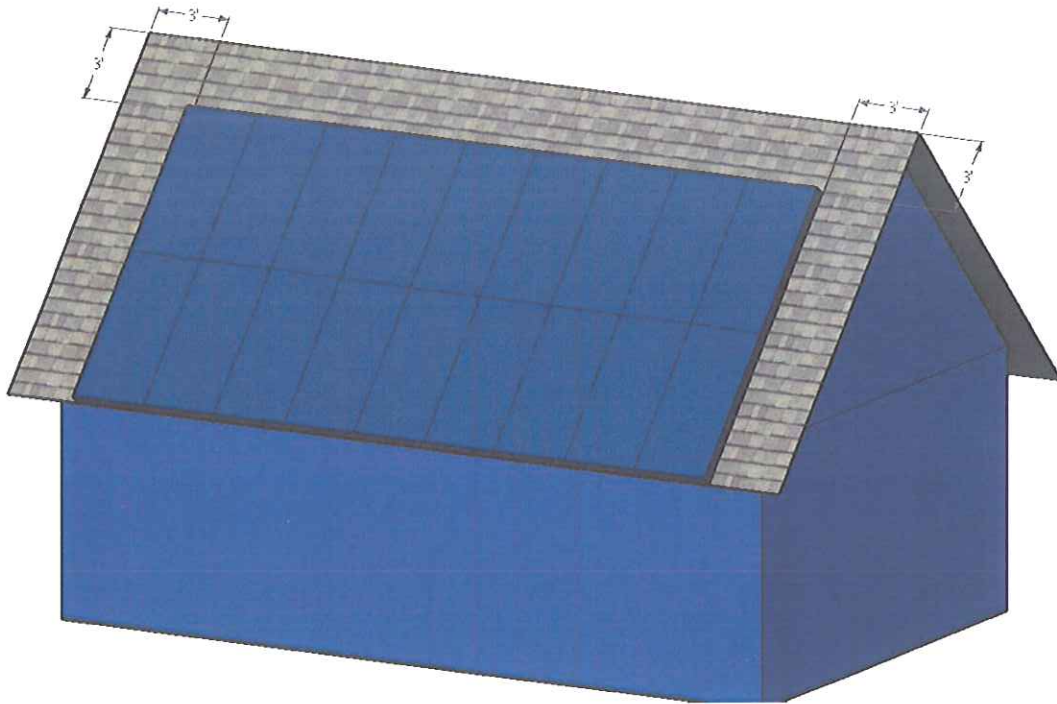
Setback requirements do not apply to ground-mounted, free standing photovoltaic arrays. A clear brush area of ten feet (10') is required for ground mounted photovoltaic arrays.



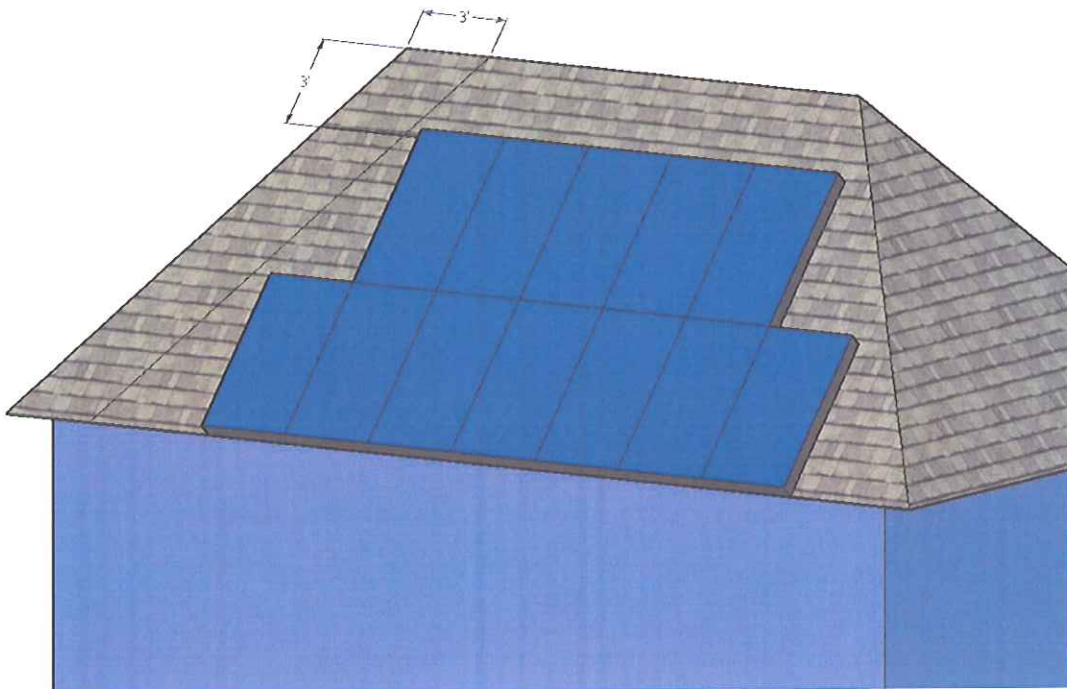
Example; residential – cross gable roof



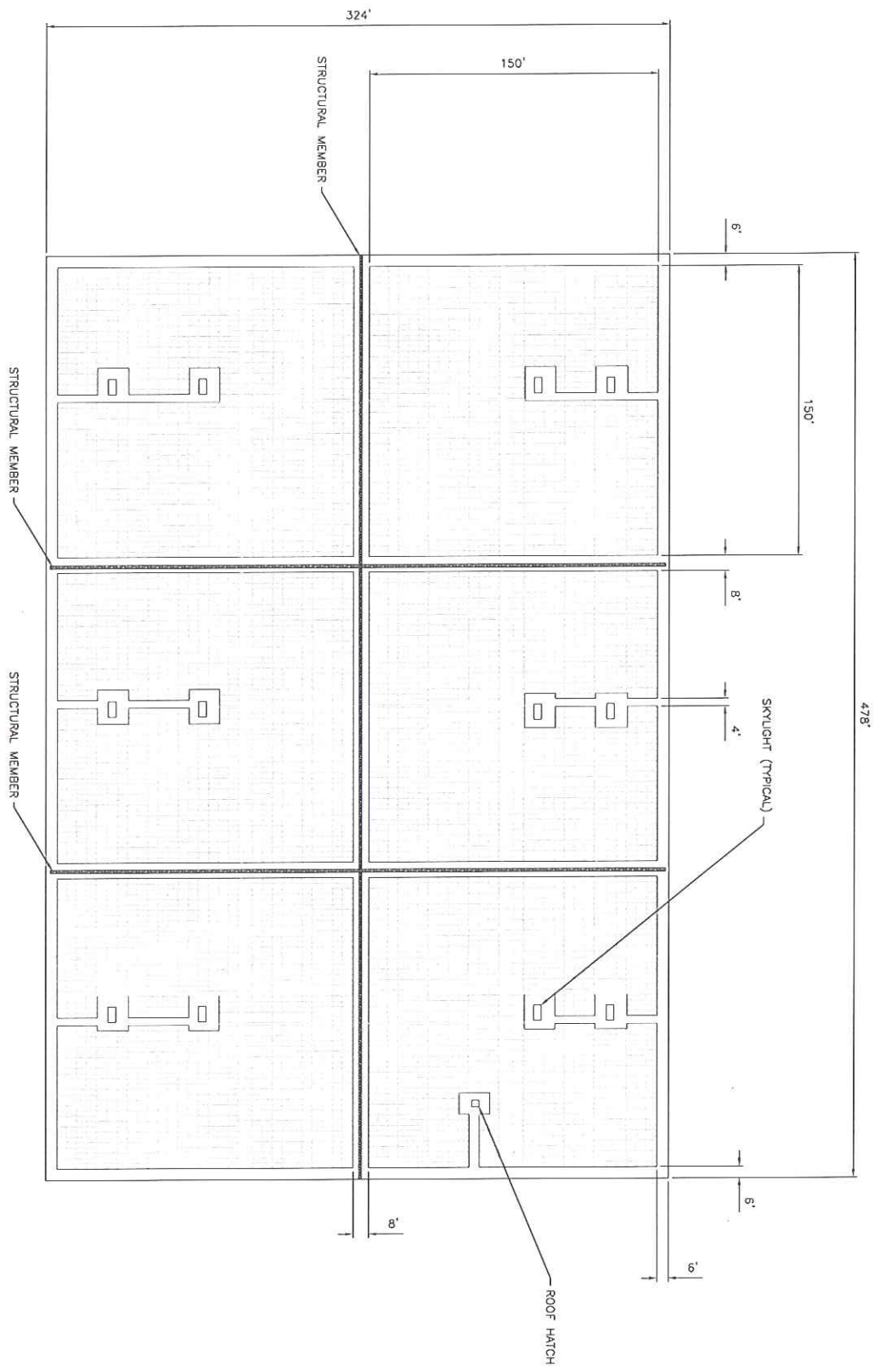
Example 2, residential, cross gable roof with valley.



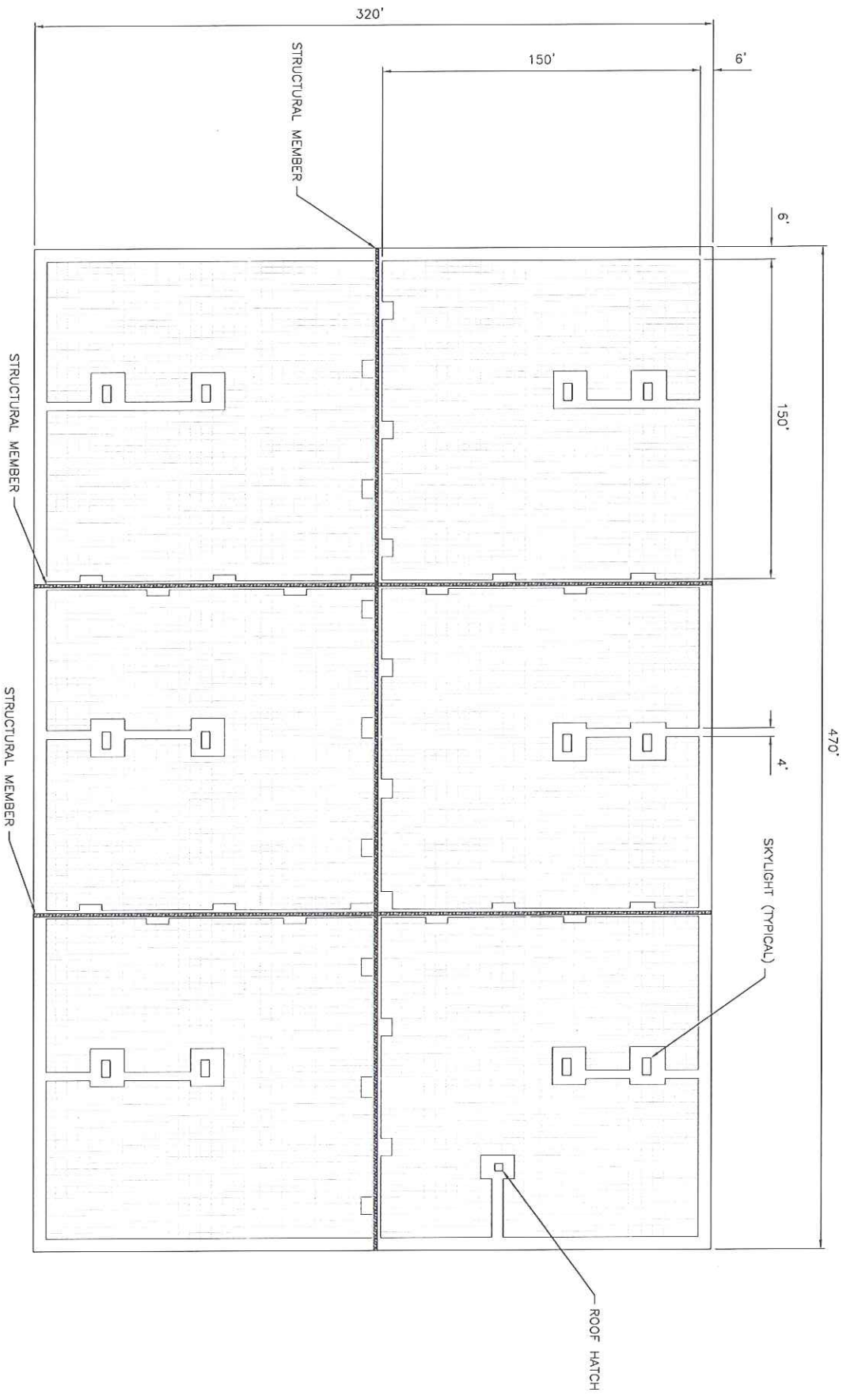
Example 3, residential, full gable



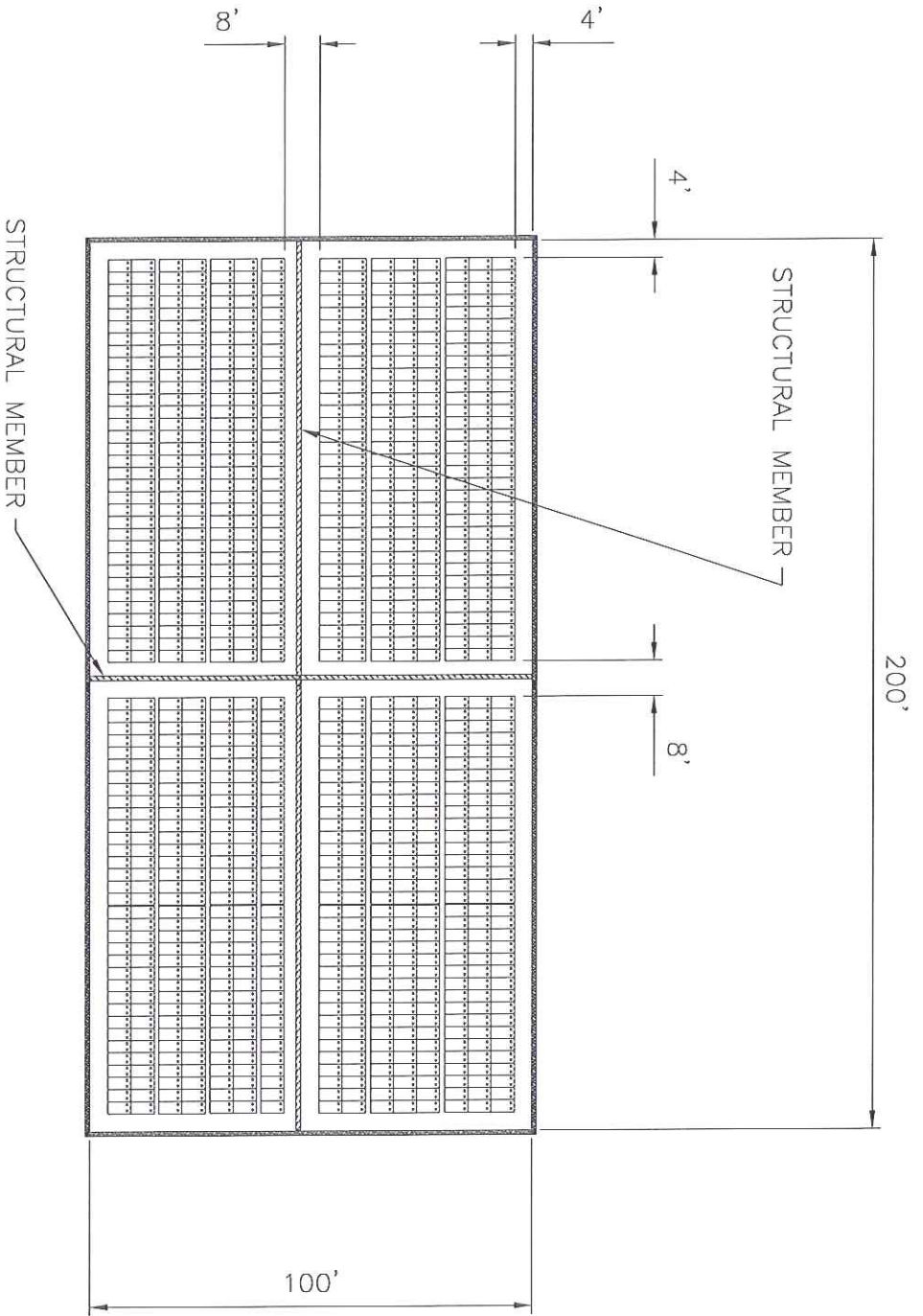
Example 4, residential, full hip roof



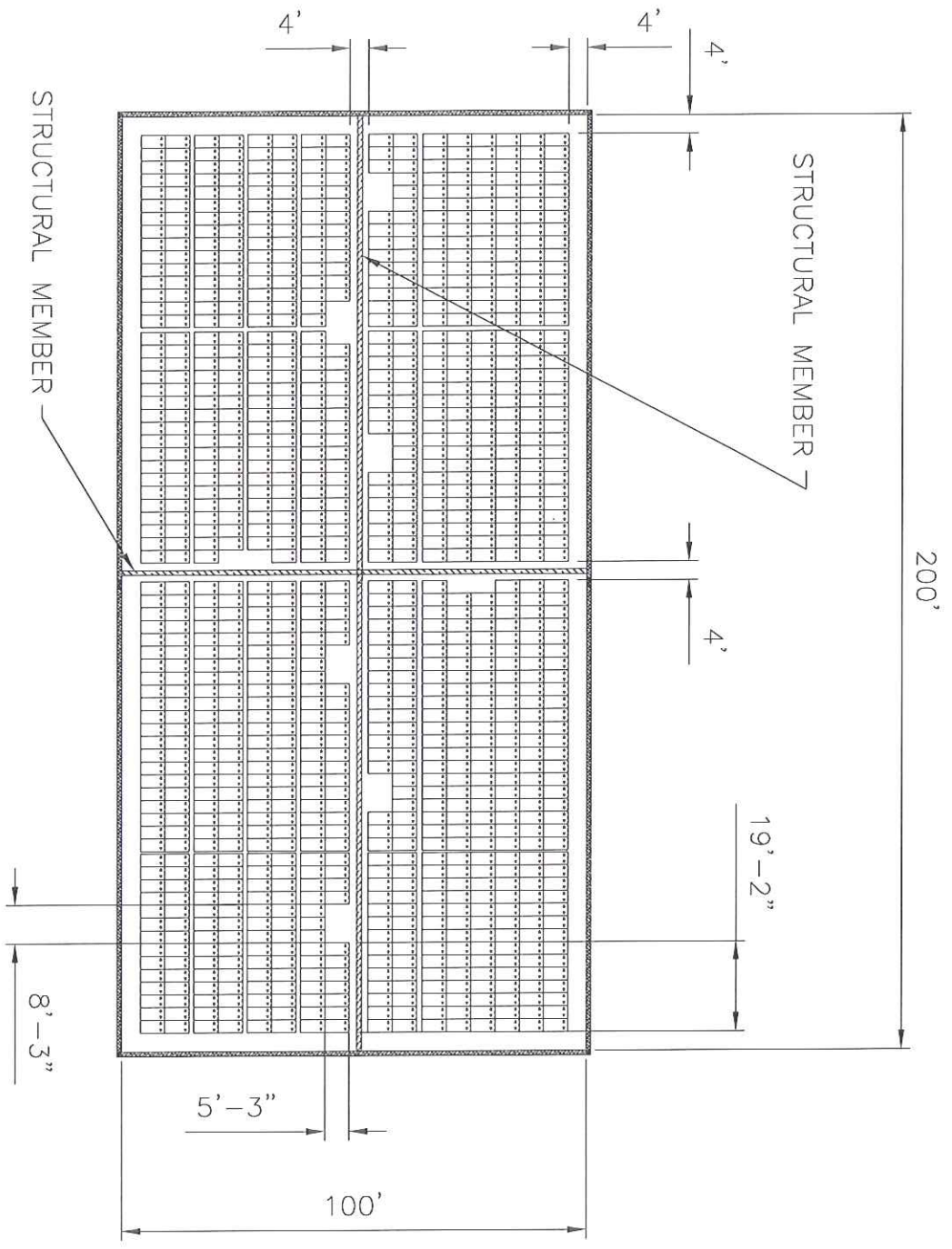
SOLAR ARRAY EXAMPLE – LARGE COMMERCIAL
 8' WALKWAYS



SOLAR ARRAY EXAMPLE - LARGE COMMERCIAL
 4' WALKWAYS WITH 8' X 4' VENTING OPPORTUNITIES EVERY 20'



SOLAR ARRAY EXAMPLE – SMALL COMMERCIAL
8' WALKWAYS



SOLAR ARRAY EXAMPLE – SMALL COMMERCIAL
 4' WALKWAYS WITH 8' X 4' VENTING OPPORTUNITIES EVERY 20' ALONG WALKWAY