



NORTHSTAR FIRE DEPARTMENT



Solar Panels / Photovoltaic Systems – Guidelines & Specifications

Fire Prevention Guideline P-06

PURPOSE

The installation of solar photovoltaic (PV) systems presents additional areas of concern for firefighter safety (energized equipment, trip hazards, etc.) and firefighting operations (restricting venting locations, limiting walking surfaces on roof structures, etc). This guideline establishes the minimum standard for the layout design, marking, and installation of solar photovoltaic systems and is intended to mitigate the fire safety issues.

SCOPE

This guideline and its requirements apply to all solar photovoltaic systems regardless of size for residential and commercial purposes.

This guideline is based upon the State Fire Marshal's Solar Photovoltaic guidelines. The technical content of the document is consistent with the SFM document except for NFD's requirements for remote disconnects.

SUBMITTAL REQUIREMENTS

1. A full set of plans submitted electronically in pdf format. At a minimum the following information shall be presented for approval:
 - 1.1 Include the applicable codes and standards.
 - 1.2 Include a complete scope of work on the cover sheet for the project. Identify if the photovoltaic system will be used as an emergency or legally required standby or optional standby power source and if it is interconnected to an alternative energy system such as a battery back-up.
 - 1.3 A Site plan (to scale) of the structure, on which the photovoltaic array are to be installed, showing the following:
 - Footprint of the building and north reference point.
 - Location of all structures on site.
 - Street address of building.
 - Access from street to building.
 - Location of arrays.
 - Location of disconnects.
 - Location of required signage.
 - Location of required access pathways.

Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10

- 1.4 Plan and elevation views of building clearly showing the following:
 - Array placement.
 - Roof ridgelines.
 - Eave lines.
 - Equipment on roof.
 - Other objects that may be present on the roof; such as, vent lines, skylights, and roof hatches.
- 1.5 Location and verbiage of all markings, labels, and warning signs must be noted on the plans.
- 1.6 Building photographs that may be useful in the evaluation of the array placement.
- 1.7 Show the location of the first responders disconnect for the system.

DESIGN REQUIREMENTS

2. **MARKINGS, LABELS, AND WARNING SIGNS** - Provides emergency responders with appropriate warning and guidance with respect to isolating the solar electrical 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. Marks, labels and warning signs shall be provided as follows:
 - 2.1 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 shall 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.
 - 2.2 DC Circuit Marking
 - 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 every ten (10) feet, at turns and above and/or below penetrations, and at all DC combiner and junction boxes.
 - 2.3 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.

Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10

2.4 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 (5) 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.

2.5 Marking Content and Format

- Marking Content: CAUTION: SOLAR CIRCUIT b) Red Background c) White Lettering d) Minimum 3/8" Letter Height e) All capital letters f) Arial or similar font, Non-bold g) Reflective weather resistant material suitable for the environment (durable adhesive materials must meet this requirement)

3. **ACCESS, PATHWAYS, and SMOKE VENTILATION** - All plans are required to be reviewed by the Fire Department for access and spacing. 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 opportunity areas.
- Provide emergency egress from the roof.

Exceptions to this requirement may be requested where access, pathway, or ventilation requirements are reduced due to the following:

- Unique site-specific limitations.
- Alternative access opportunities (as from adjoining roofs).
- Ground level access to the roof area in question.
- Other adequate ventilation opportunities when approved by the fire code official.
- Adequate ventilation opportunities afforded by panel set back from other rooftop equipment (for example: shading or structural constraints may leave significant areas open for ventilation near HVAC equipment).
- Automatic ventilation device.

Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10

- 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 are measured to centerlines.
- 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.

3.2 Residential —Single and Two-Unit Residential Dwellings

- Access for Buildings with hip roof layout:
 - Panels shall be located in a manner that provides one three-foot wide clear access pathway from the eave to the ridge on each roof slope where panels are located.
 - The access pathway shall be located at a structurally strong location on the building (i.e. bearing wall).
- Access for Buildings with ridge roof layout:
 - Panels shall be located in a manner that provides two three-foot wide access pathways from the eave to the ridge on each slope where panels are located.
 - Access pathway clear width shall not include any eaves overhang.:
- Dead ends:
 - Where there are two or more access pathways the clear pathways shall be arranged so there are no dead ends greater than 25 feet in length.
 - If any access pathway leading to a dead end is greater than 25 feet in distance it shall continue on to the next access pathway.
 - At no time shall any access pathway cause a person's travel distance to exceed 150 feet before arriving at another required access pathway.
- Ventilation:
 - An uninterrupted section of photovoltaic panels (array) shall not exceed 150 feet by 150 feet in dimension in either axis.
 - Panels shall be located no higher than three feet below the ridge.

EXCEPTION: The panels may be located two feet below the ridge if the Department has determined that an approved product or method will provide an equal or greater opportunity for ventilation.

3.3 Commercial Buildings and Residential Housing Comprised of Three or More Units:

- Access:
 - A minimum six-foot wide clear perimeter is required 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.

Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10

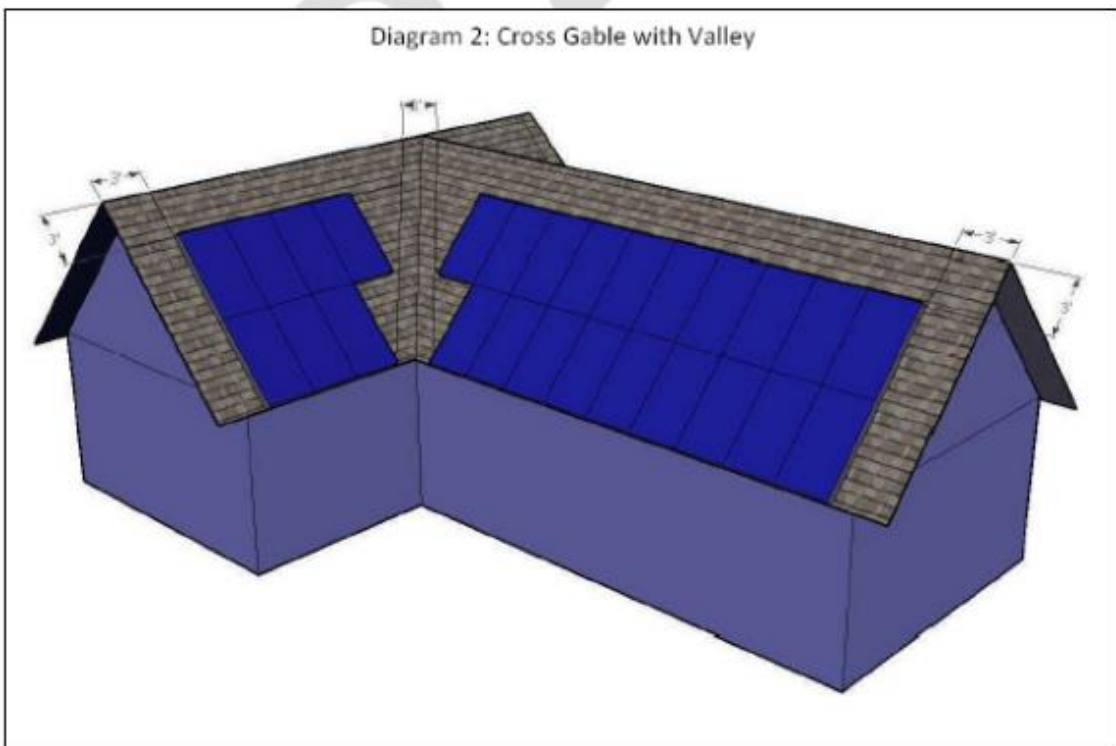
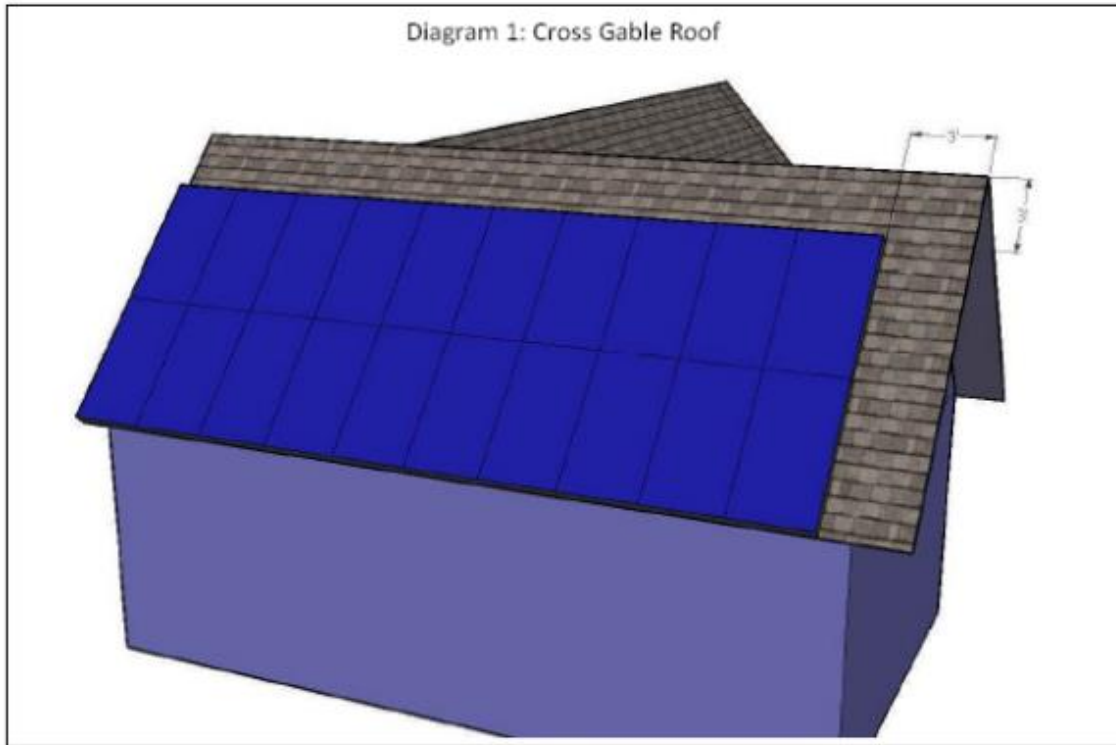
- Pathways: Shall be established in the design of the solar installation and meet the following:
 - Located over structurally supported members.
 - Center line axis pathways shall be provided in both axis of the roof. Centerline axis pathways shall run on structurally supported members or over the next closest structurally supported member nearest to the centerlines of the roof.
 - A minimum of four feet clear straight-line pathway shall be provided from the access path to skylights and/or ventilation hatches.
 - A minimum of four feet clear straight-line pathway shall be provided from the access to roof standpipes.
 - Not less than four feet clear around roof access hatches with a minimum of one pathway that is straight and not less than four feet clear to the parapet or roof edge.
- Ventilation:
 - Arrays shall be no greater than 150 feet by 150 feet in dimension in either axis.
 - Ventilation options between array sections shall be one of the following:
 - An access pathway eight feet or greater in width.
 - The access pathways shall be four feet or greater in width and bordering on the existing roof skylights or ventilation hatches.
 - The access pathways shall be four feet or greater in width with bordering 4 feet by 8 feet "venting cutouts" every 20 feet on alternating sides of the pathway.

4. LOCATION OF DC CONDUCTORS

- 4.1 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.
- 4.2 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.
- 4.3 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.

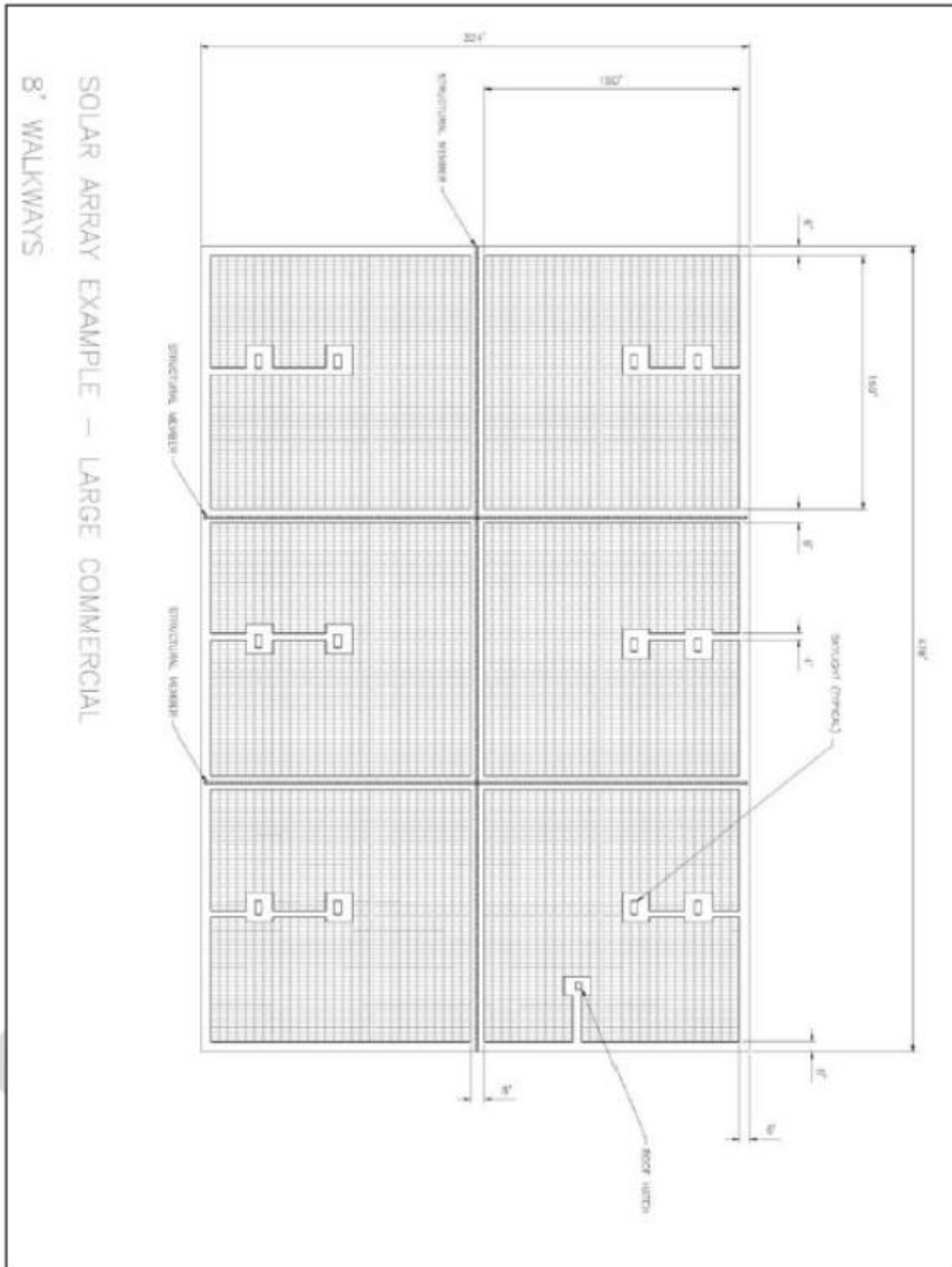
Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10



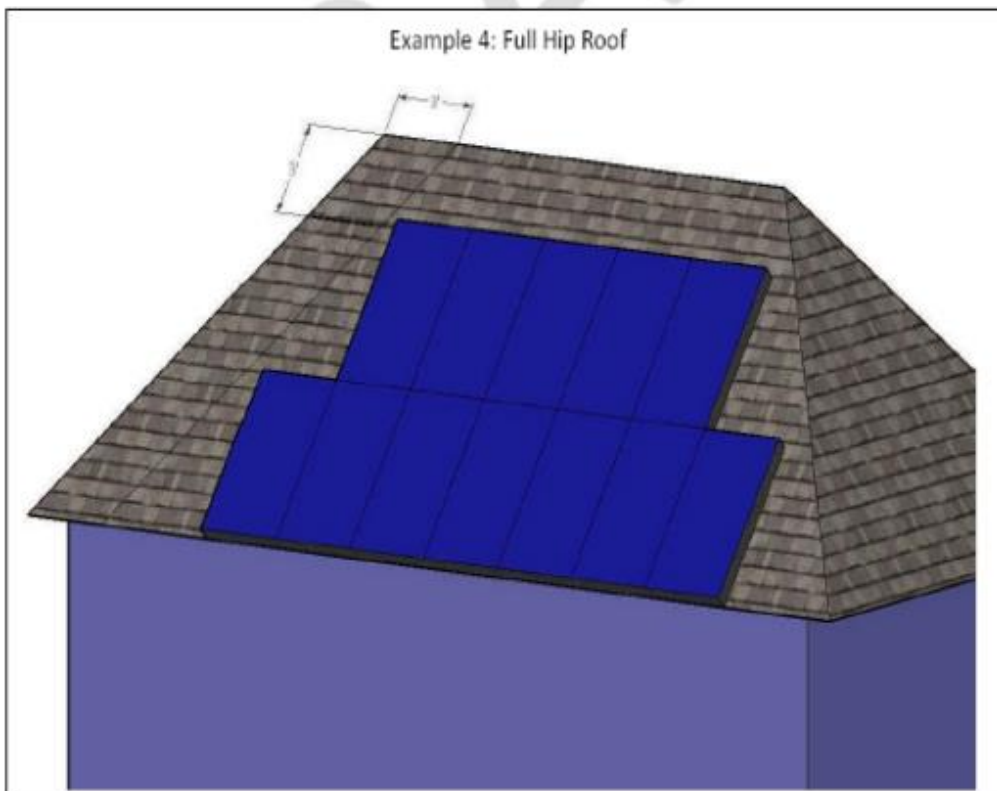
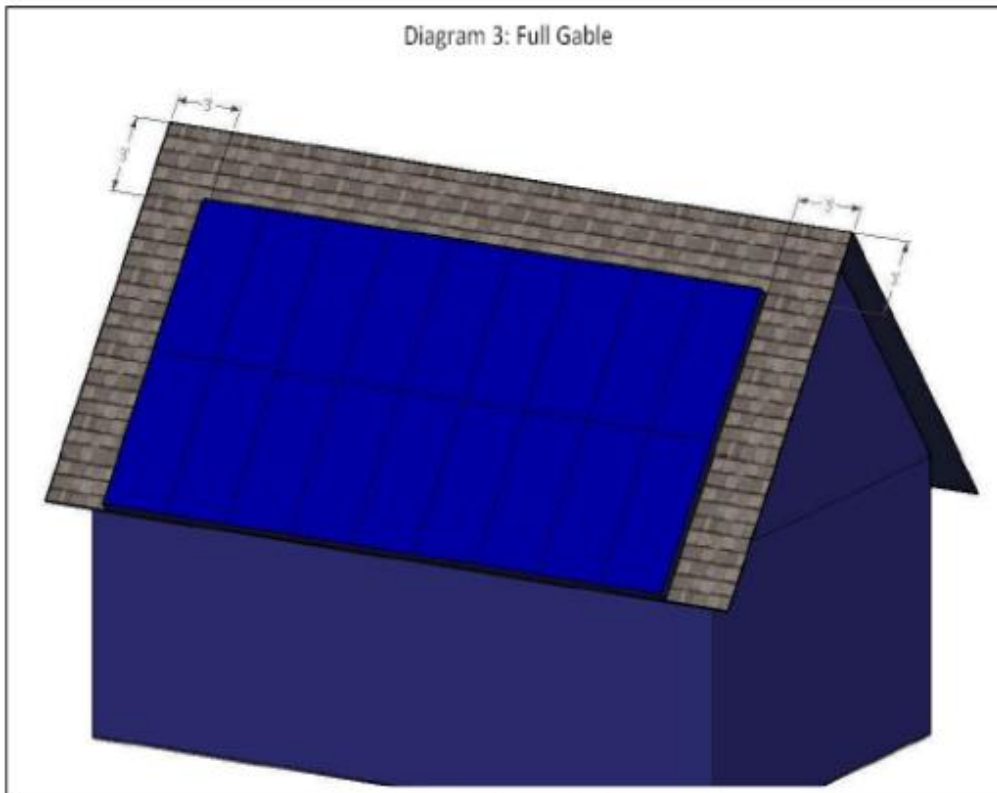
Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10



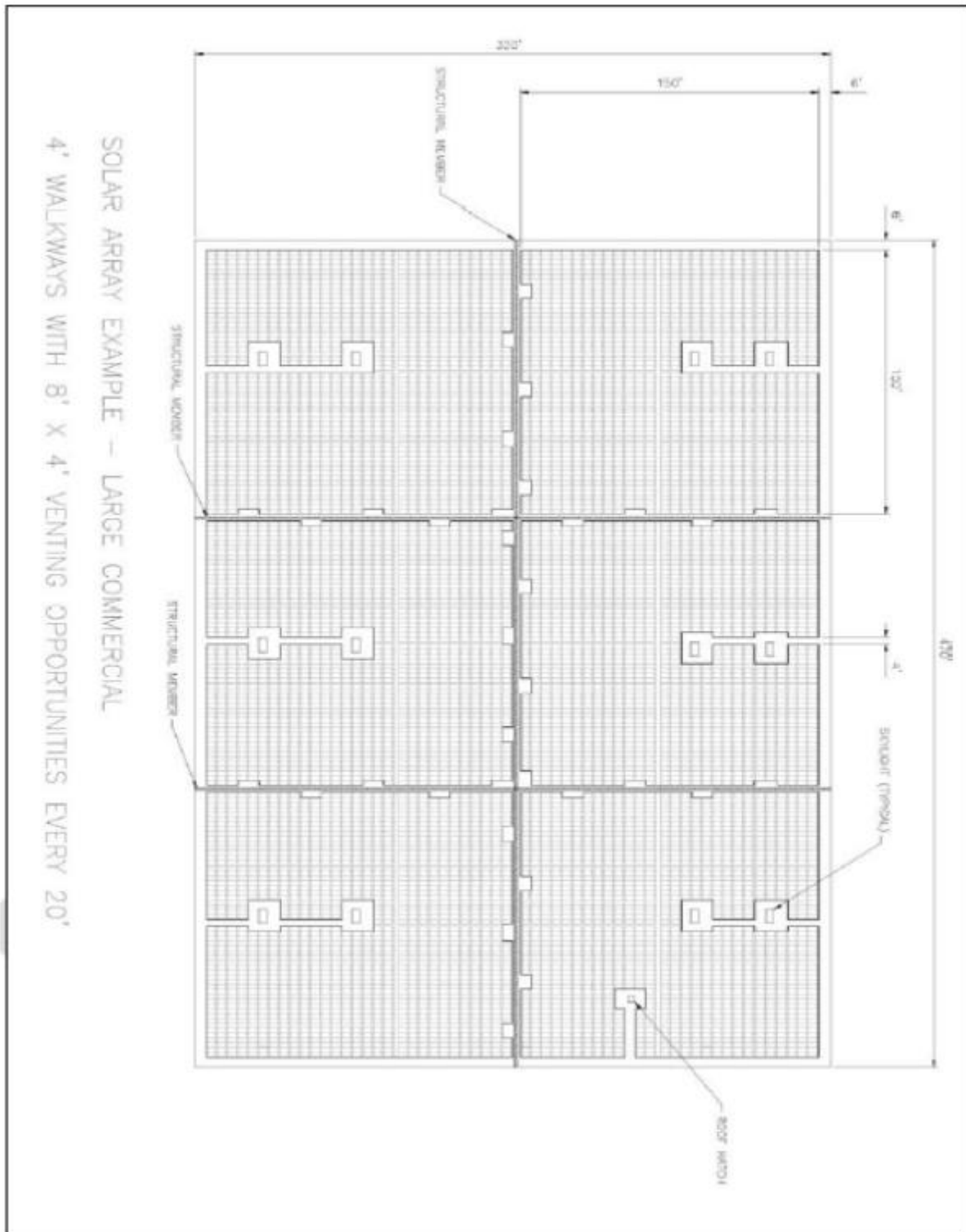
Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10



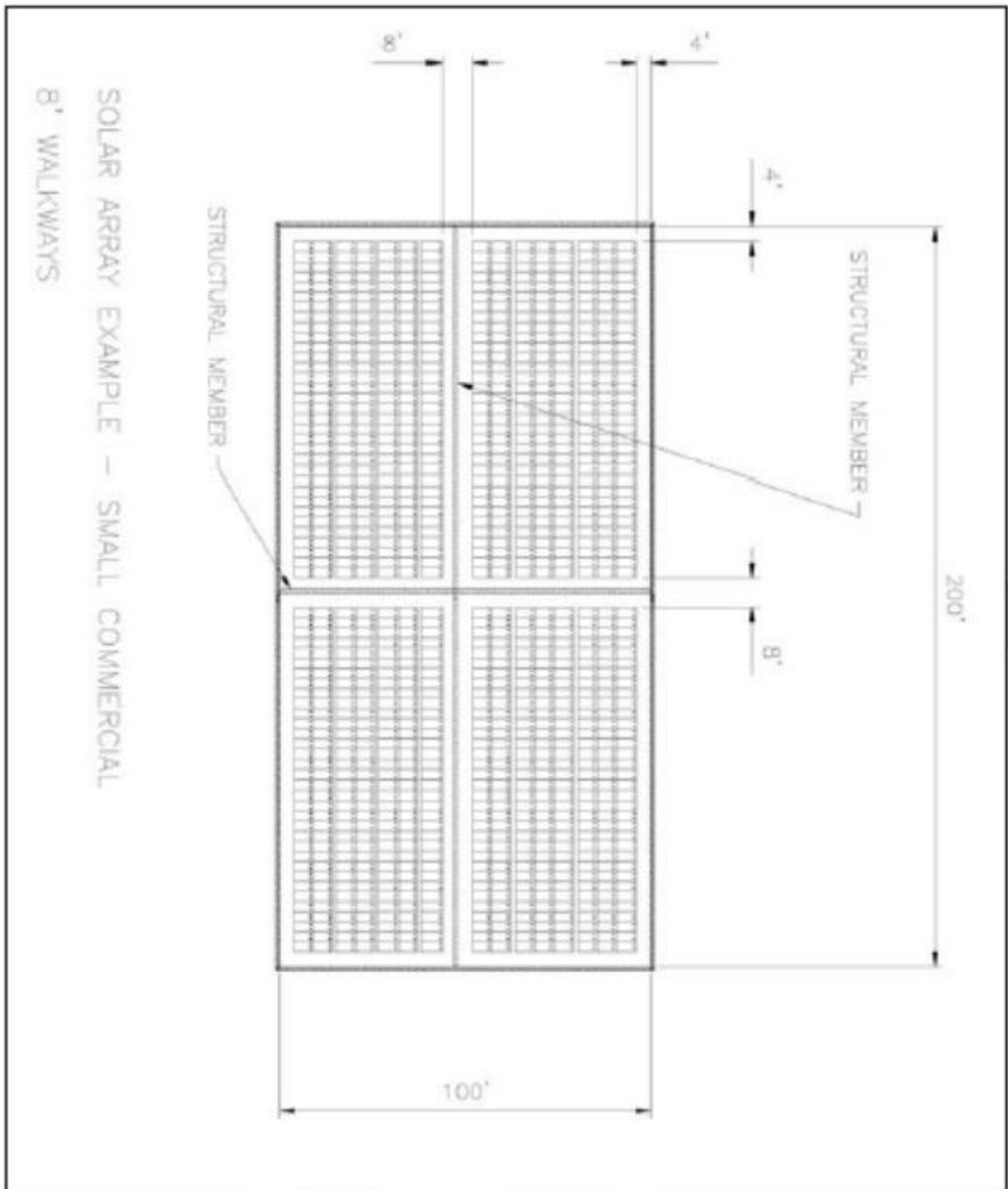
Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10



Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10



Solar Panels / Photovoltaic Systems - Guidelines & Specifications

Fire Prevention Guideline P-10

