GSA FIRE SAFETY GUIDELINE
FOR
PHOTOVOLTAIC SYSTEM INSTALLATIONS

PURPOSE

The intent of this guideline is to provide information necessary to ensure safety at GSA Federal buildings equipped with photovoltaic systems.

SCOPE

This guideline is applicable to all photovoltaic systems, regardless of size, for GSA Federal buildings.

DEFINITIONS

Array: Any number of photovoltaic modules connected together to provide a single electrical output.

Inverter: Devices that convert DC electricity (single or multiphase), either for stand alone systems (not connected to the grid) or for utility-interactive systems, from solar power to the AC electricity for use in the building's electrical system or the grid, or both.

Photovoltaic (PV) System: The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to a utilization load.

BACKGROUND

The installation of PV systems presents concerns for safety (energized equipment, trip hazards, etc.) and fire fighting operations (restricting venting locations, limiting walking surfaces on roof structures, etc.). This guideline addresses these issues while embracing the environmental advantages of this technology.

ROLES AND RESPONSIBILITIES

A. GSA Project Manager

- Prior to the PV system installation, the GSA Project Manager shall coordinate a meeting with the Contractor, GSA Property Manager, GSA Fire Protection Engineer, GSA Safety Specialist, and local fire official to ensure the proposed PV system design and layout is acceptable to all parties.
- Prior to the acceptance of the PV system, the GSA Project Manager shall confirm that the PV system has been tested. All testing shall be witnessed and documented by a qualified independent third party test entity.

B. Third Party Test Entity

- The third party test entity shall have an advanced understanding of the installation, operation, and maintenance of the PV system installed. Third party test entities shall be licensed (certified) where required by applicable codes and standards.
- At completion of witnessing the PV system testing, the third party test entity shall provide to the GSA Project Manager documentation verifying that the PV system is in compliance with the design and specifications and all applicable codes and standards.

REQUIREMENTS

The installation of PV systems at GSA Federal buildings shall comply with the requirements in the *International Building Code* and National Fire Protection Association (NFPA) 70, *National Electrical Code,* and the following requirements:

A. MARKING. PV systems shall be marked in accordance with NFPA 70, Article 690, and the following:

1) Direct Current (DC) Circuits. All interior and exterior DC conduits, raceways, enclosures, cable assemblies, and junction boxes associated with the PV system shall be marked to alert individuals that DC power is present. The marking shall be placed every ten (10) feet or fraction thereof, at turns and above and below penetrations, and on all DC combiner and junction boxes.

a) Content. The marking shall contain the text **"CAUTION: PV CIRCUIT ENERGIZED"** in capital letters a minimum of 3/8 inches in height with white letters on a red background. The materials used for marking shall be reflective and weather resistant in accordance with UL 969 that is suitable for the environment.

2) Stairway access to roofs. Signage is required on all stairway doors providing access to the roof where PV systems are installed. Each stairway door providing access to the roof shall have a sign affixed to the interior side of the stairway door.

a) Content. The signage shall contain the text "**CAUTION PHOTOVOLTAIC SYSTEM INSTALLED ON ROOF**". The sign shall consist of letters having a principal stroke of not less than ¾ inch wide and be at least six (6) inches high on a contrasting background.

B. Fire Department Access, Pathways, and Smoke Ventilation. Access and spacing requirements shall be maintained and provided in order to ensure the following is provided on roofs with PV systems:

1) **Access**. There shall be a minimum six (6) 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 (4) feet wide clear perimeter around the edges of the roof.

2) **Ground Ladder Access**. In low-rise buildings, ground ladder roof access shall correspond with roof pathways and shall not be located over an opening (i.e., windows or doors). Ground ladder access points shall be located at strong points of the building construction and not in conflict with overhead obstructions (i.e., tree limbs, wires or signs).

3) **Pathways**. The PV system shall be designed such that designated pathways are provided on the roof. The pathways shall meet the following requirements:

   a) The pathway shall be located over structural roof members.
   b) The center line axis pathways shall be provided in both axes of the roof. The center line axis pathways shall be located on structural members or located on the next closest structural member nearest to the center lines of the roof.
   c) Each pathway shall be a straight line and not less than four (4) feet in clear width to skylights and/or ventilation hatches.
   d) Each pathway shall be a straight line and not less than four (4) feet in clear width to each roof standpipe outlet.
   e) Each pathway shall provide not less than four (4) feet clear width around each roof access hatch with at least one pathway not having less than a four (4) feet clear width to the parapet or roof edge.

4) **Smoke Ventilation**. The PV system shall be designed such that smoke ventilation opportunity areas are provided on the roof and meet the following requirements:

   a) Each array shall be no greater than 150 x 150 feet in distance in either axis.
   b) Ventilation options between array sections shall meet one of the following:

      (1) a pathway eight (8) feet or greater in width;
      (2) a pathway four (4) feet or greater in width that borders on existing roof skylights or ventilation hatches; or
      (3) a pathway four (4) feet or greater in width bordering 4’ x 8’ “venting cutouts” every 20 feet on alternating sides of the pathway.

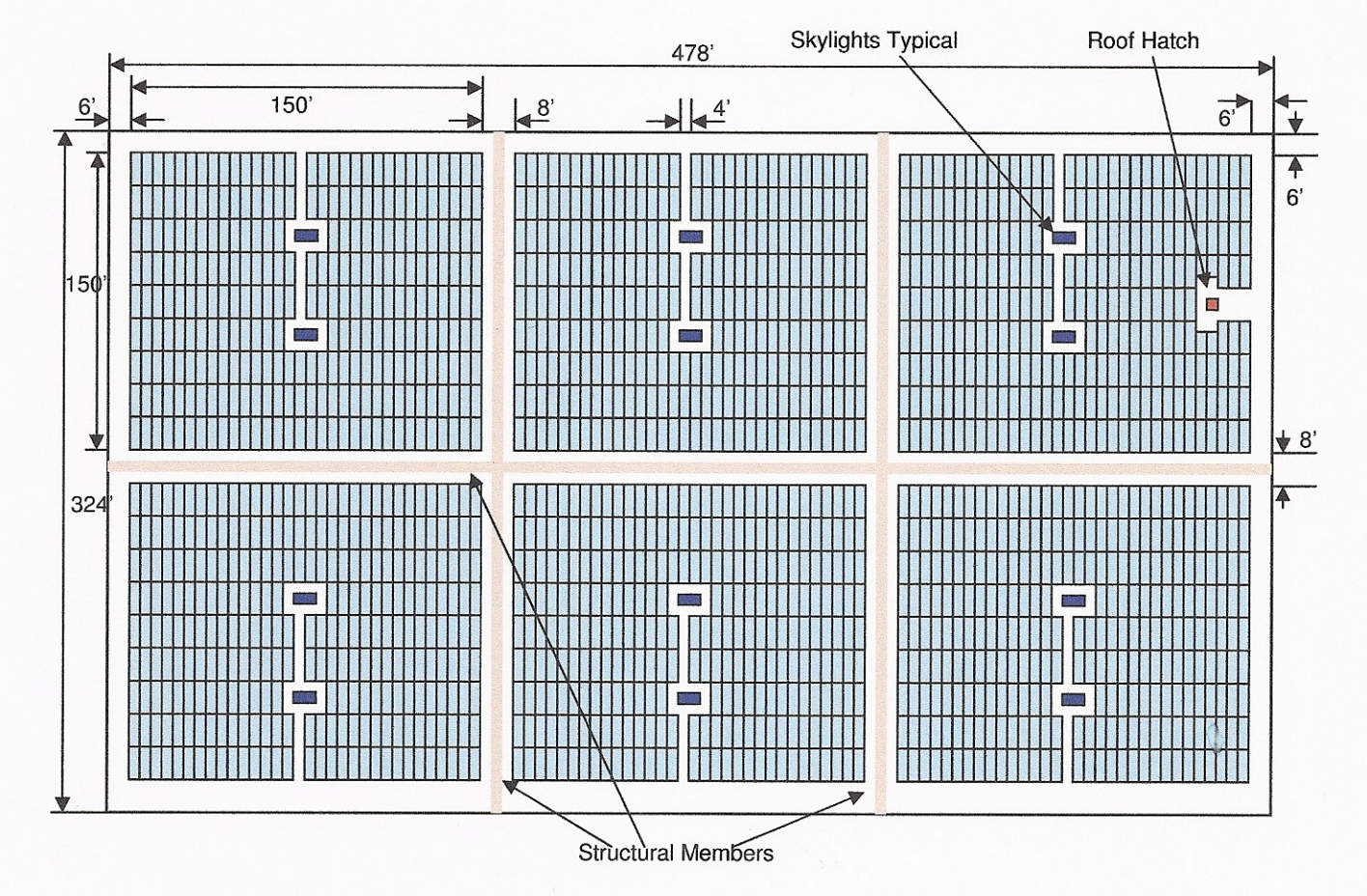
C. Location of DC Conductors. Exposed conduit, wiring systems, and raceways for PV circuits shall be located as close as possible to the ridge or hip or valley on the roof to reduce trip hazards and maximize ventilation opportunities.

Conduit runs between sub-arrays and conduit runs to DC combiner boxes shall be designed in a manner that minimizes total amount of conduit on the roof. The DC combiner boxes shall be located such that conduit runs are minimized in the pathways between arrays.

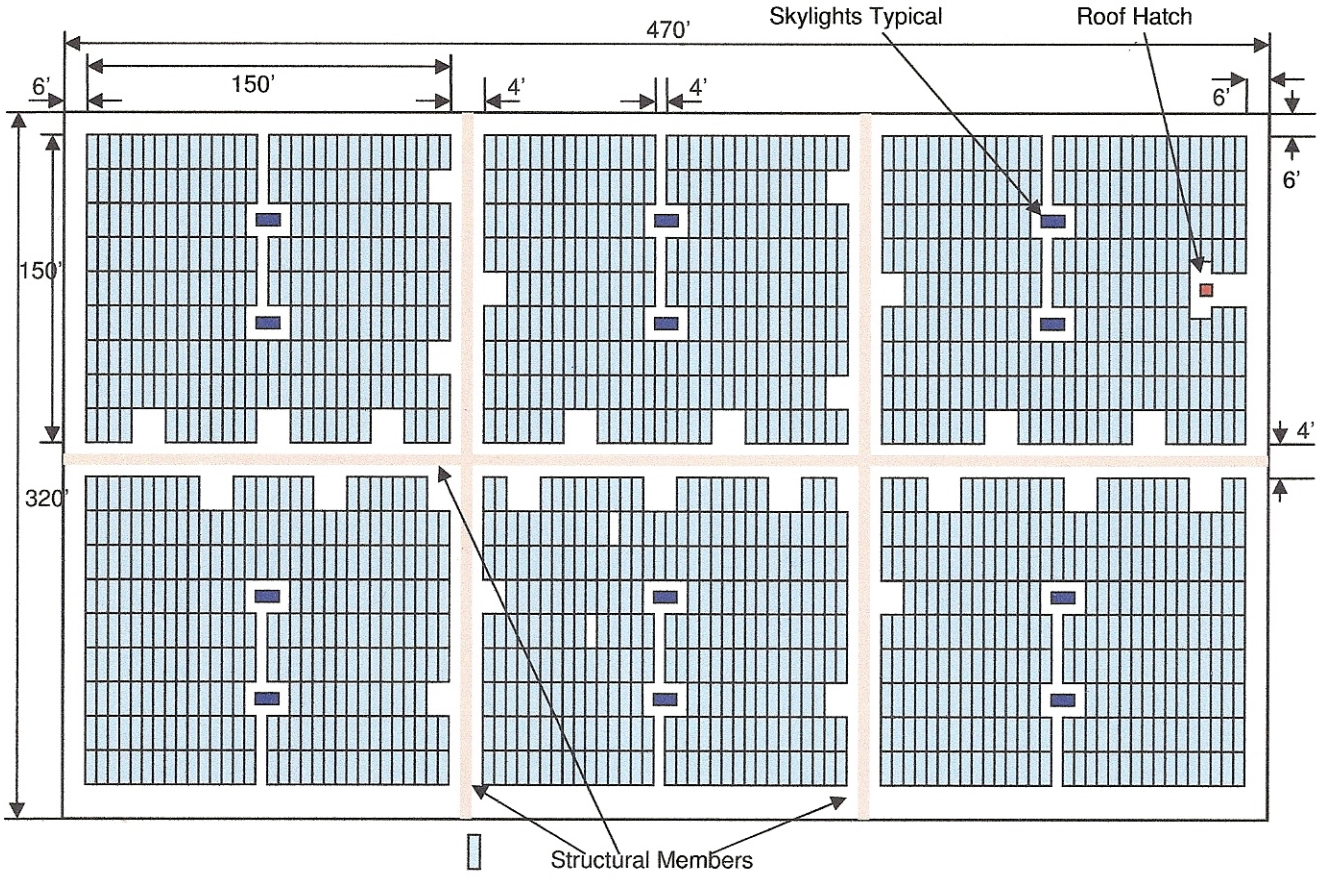
To limit the hazard of cutting live conduit in fire department venting operations, DC wiring shall be run in metallic conduit or raceways when located within enclosed spaces in a building and shall be run, to the maximum extent possible, along the bottom load-bearing members.

D. Ground mounted PV arrays. Ground mounted PV arrays shall also comply with the above applicable requirements. Setback requirements do not apply to ground-mounted, free standing PV arrays, however, a clear brush area of ten (10) feet on all sides is required for ground mounted PV arrays.

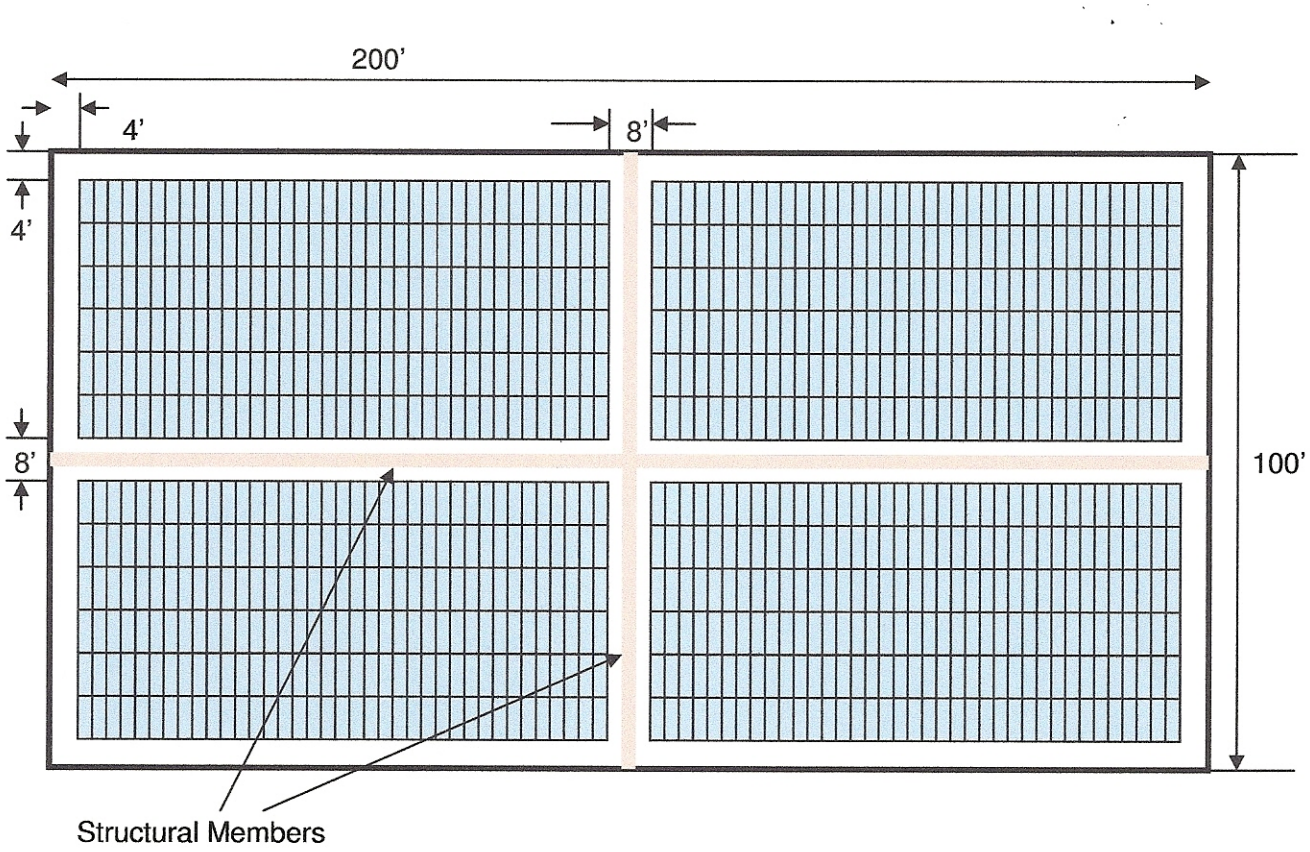
PV Array Example
Large Commercial Building (Axis > 250 ft)
8 ft Walkways



PV Array Example
Large Commercial Building (Axis > 250 ft)
4 ft Walkways
8 ft x 4 ft Venting Opportunities Every 20 ft Along Walkway



PV Array Example
Small Commercial Building (Axis < 250 ft)
8 ft Walkways



PV Array Example
Small Commercial Building (Axis < 250 ft)
4 ft Walkways
8 ft x 4 ft Venting Opportunities Every 20 ft Along Walkway