DFC 10/2009

ALBUQUERQUE FIRE DEPARTMENT
SOLAR PHOTOVOLTAIC SYSTEM
INSTALLATION GUIDELINES

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I. Purpose:

The installation of solar photovoltaic (PV) systems presents additional areas of concern for firefighter safety and fire fighting operations including: energized equipment, trip hazards, 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.

II. Scope:

The following are the City of Albuquerque Fire Department's minimum requirements for Solar Photovoltaic System Installations and their ancillary devices, regardless of size, on Municipal Buildings.

III. Plan Review:

All solar installations on Municipal Buildings shall be approved by the City of Albuquerque Planning Department and the Albuquerque Fire Department.

At a minimum the following information shall be presented for approval:

A. Site Plan (to Scale) of the structure, on which the photovoltaic systems are to be installed to include the following:
- Street address of building.
- Footprint of the building and north reference point.
- Location of all structures on site.
- Access from street to the building.
- Location of arrays.
- Locations of disconnects.
- Locations of required signage.
- Locations of required access pathways.

B. Plan and elevations views of buildings clearly showing the following:
- Array Placement.
- Roof ridgelines.
- Eave lines.
- Equipment on the roof.
- Other objects that may be present on roof e.g. vent lines, skylights, smoke vents, roof hatches, fire department connection etc.
- Location of disconnects.
- Location and verbiage of all marking, labels and warning signs.
- Location of required access pathways.

C. Building photographs that may be useful in the evaluation of the array placement.

IV. Permits

All required Zoning, Building and Electrical permits shall be obtained from the City's Planning department prior to solar photovoltaic installation.

No Fire Department permits are required.

V. Markings, Labels and Warning Signs.

A. General Requirements:

1. Marking of Buildings: All entrances to habitable buildings and structures where photovoltaic systems are installed shall be identified with an approved sign (see example) alerting emergency responders of the PV System.

Sign Size, Content and Placement

- Minimum of 12" X 12" Aluminum
- White Background
- 4" Black Outlined Triangle with yellow background and Black Voltage Symbol Centered in Triangle
- The sign shall consist of black letters having a principle stroke of not less the ¼" wide and at least 3 ½" high.
- Signs shall be permanently attached to the door by means of the following methods.
- Metal doors to be attached using tamper proof screws, glass doors to be attached with a sticky back film over the entire sign.
- Mounting height shall be at 5ft.-6in. to the center of the sign and centered on the doorway.

2. Marking of PV Systems: 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.

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

B. Main Service Disconnect:

- Marking Content: CAUTION: SOLAR ELECTRIC SYSTEM 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 must meet this requirement)

CAUTION: SOLAR CIRCUIT DISCONNECT

C. Marking DC Circuit:

1. 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.

   Exception: Existing non-accessible conduit.

2. Marking shall be placed every 10 feet, at turns and above and/or below penetrations, **and at all DC combiner and junction boxes.**

3. 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 must meet this requirement)

CAUTION: SOLAR CIRCUIT

D. Inverters: Inverters are not required to have Caution Markings.

VI. Access, Pathways and Smoke Ventilation

A. General Requirements:

1. Access, Pathway, and Smoke Ventilations spacing requirements shall be observed in order to:
   - Ensure access to the roof.
   - Provide pathways to specific areas of the roof to include mechanical equipment and skylights.
   - Provide for smoke ventilation opportunities areas.
   - Provide emergency egress from the roof.

2. 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.

B. Access:

1. 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.

C. Pathways:

1. Pathways shall be established in the design of the solar installation and meet the following requirements:
   - Pathways should be over structural members.
   - 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.
   - It shall be in a straight line not less than four feet clear width to skylights and/or ventilation hatches
   - It shall be in a straight line not less than four feet clear width to roof fire protection standpipe outlets.
   - 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.

2. 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.
   - At no time shall any access pathway cause a person's travel distance to exceed 150 feet before arriving at another required access pathway.

D. Ventilation:

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

2. Ventilation options between array sections shall be either:
   - A pathway eight feet or greater in width
   - Four feet or greater in width pathway and bordering on existing roof skylights or ventilation hatches Four feet or greater in width pathway and bordering 4' x 8' "venting cutouts" every 20 feet on alternating sides of the pathway. **Exception:** Buildings that are protected with a NFPA 13 compliant fire sprinkler system.

VII. Direct Current (DC) Conductor Locations

A. Conduit, Wiring Systems, and Raceways shall be installed as follows:

1. Conduit, wiring systems, and raceways for photovoltaic circuits shall be located as close to the array as possible to reduce trip hazards and maximize ventilation opportunities. In no case shall the conduit and wiring systems be located in required Access or Pathways.

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.

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.

VIII. Ground Mounted Photovoltaic Arrays

A. Site Plan

1. A site plan shall be submitted to the Albuquerque Fire Department for review to include the following:
   - Street address of building.
   - Location of all structures on site.
   - Access from street to the array.
   - Location of arrays.
   - Locations of disconnects.
   - Locations of required signage.

B. Location

1. Array shall not obstruct Fire Department Access.
2. No open storage or accumulation of combustible materials, to include trash and dry vegetation shall be within 10 feet minimum of ground-mounted photovoltaic systems

IX. Non- Habitable Buildings

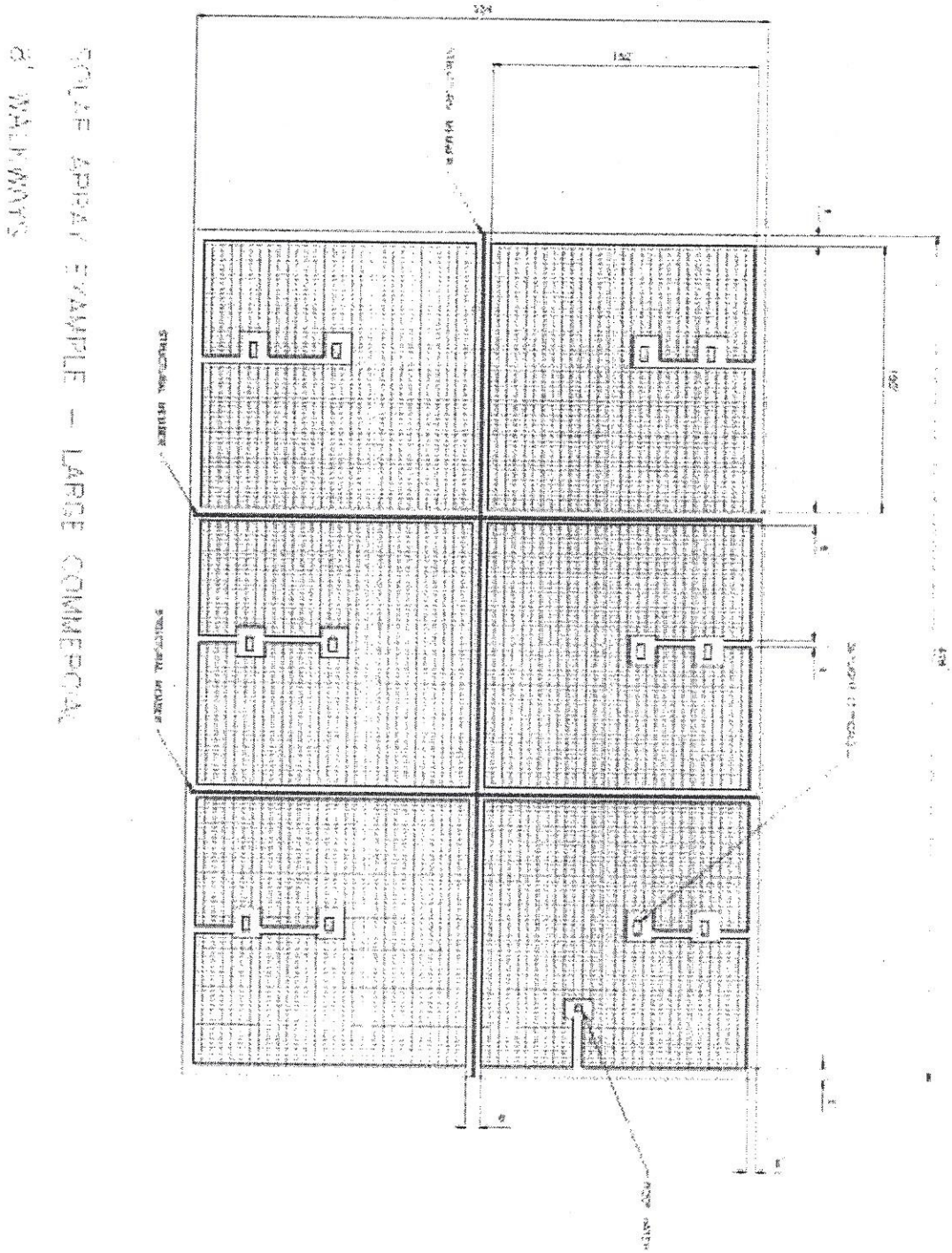
These guidelines do not apply to non-habitable structures. Example of non-habitable structures include, but are not limited to, shade structures, detached carports, solar trellises, etc.

X. Key Boxes

A. An approved key box shall be installed on every building and structure to provide immediate access for firefighters and shall:

1. Be installed in approved location.
2. Contain keys to gain necessary access.
3. Contain a site drawing of the facility and one-line diagram of the PV System.

Example 1



SCALE: 1/64" = 1'-0" EXAMPLE – LARGE CONDO

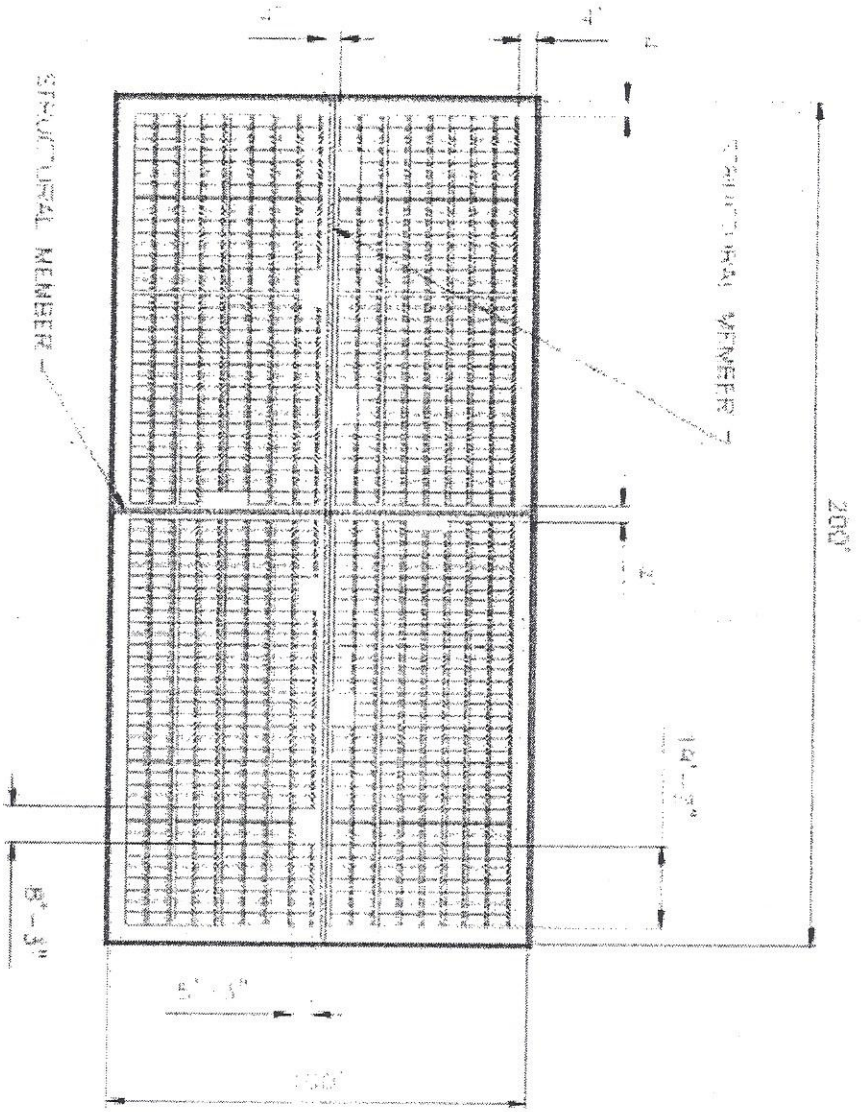
24" WALL MARKS

Example 2

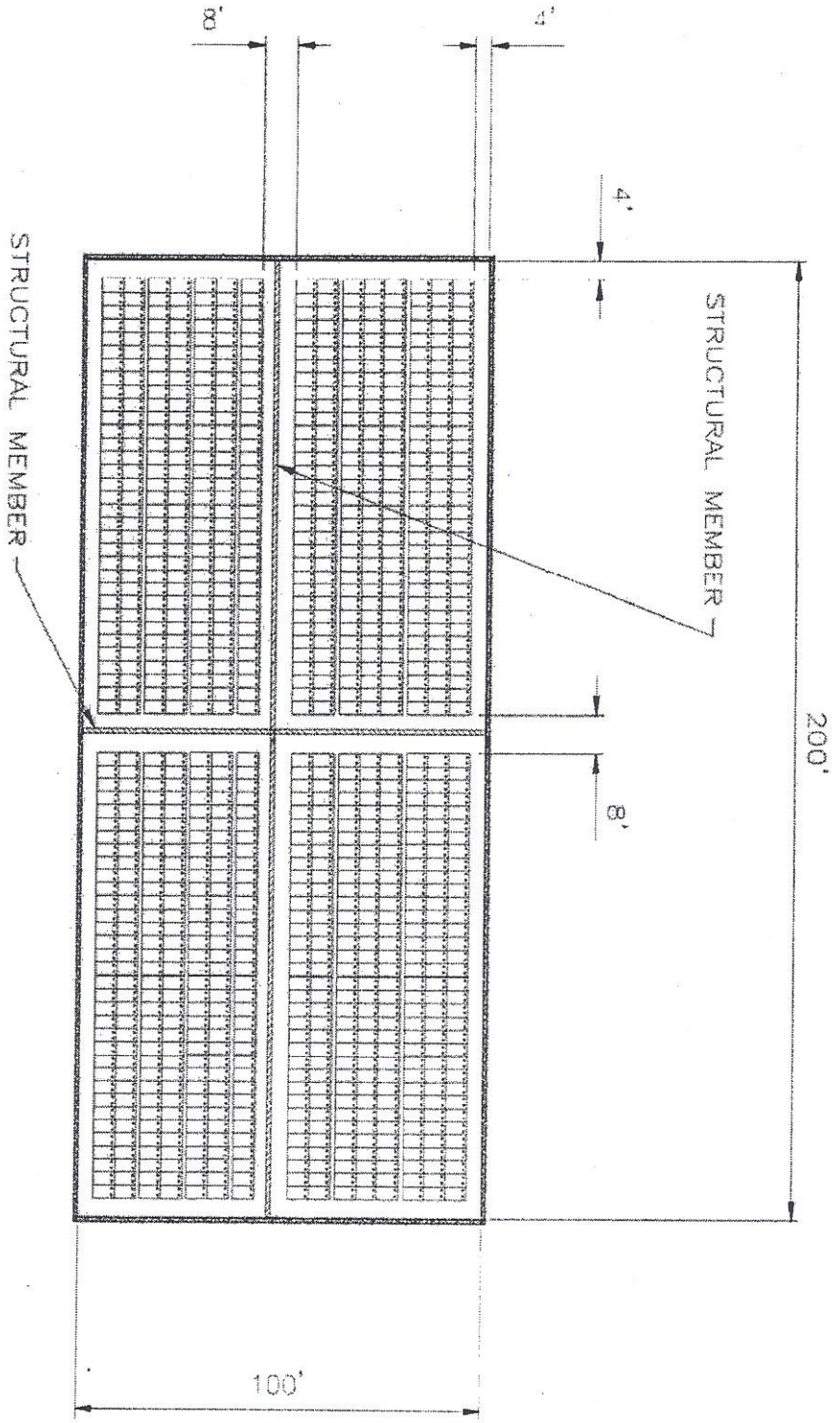
SOLAR ARRAY EXAMPLE – LARGE COMMERCIAL

4' WALKWAYS WITH 8' X 4' VENTING OPPORTUNITIES EVERY 20'

Example 3

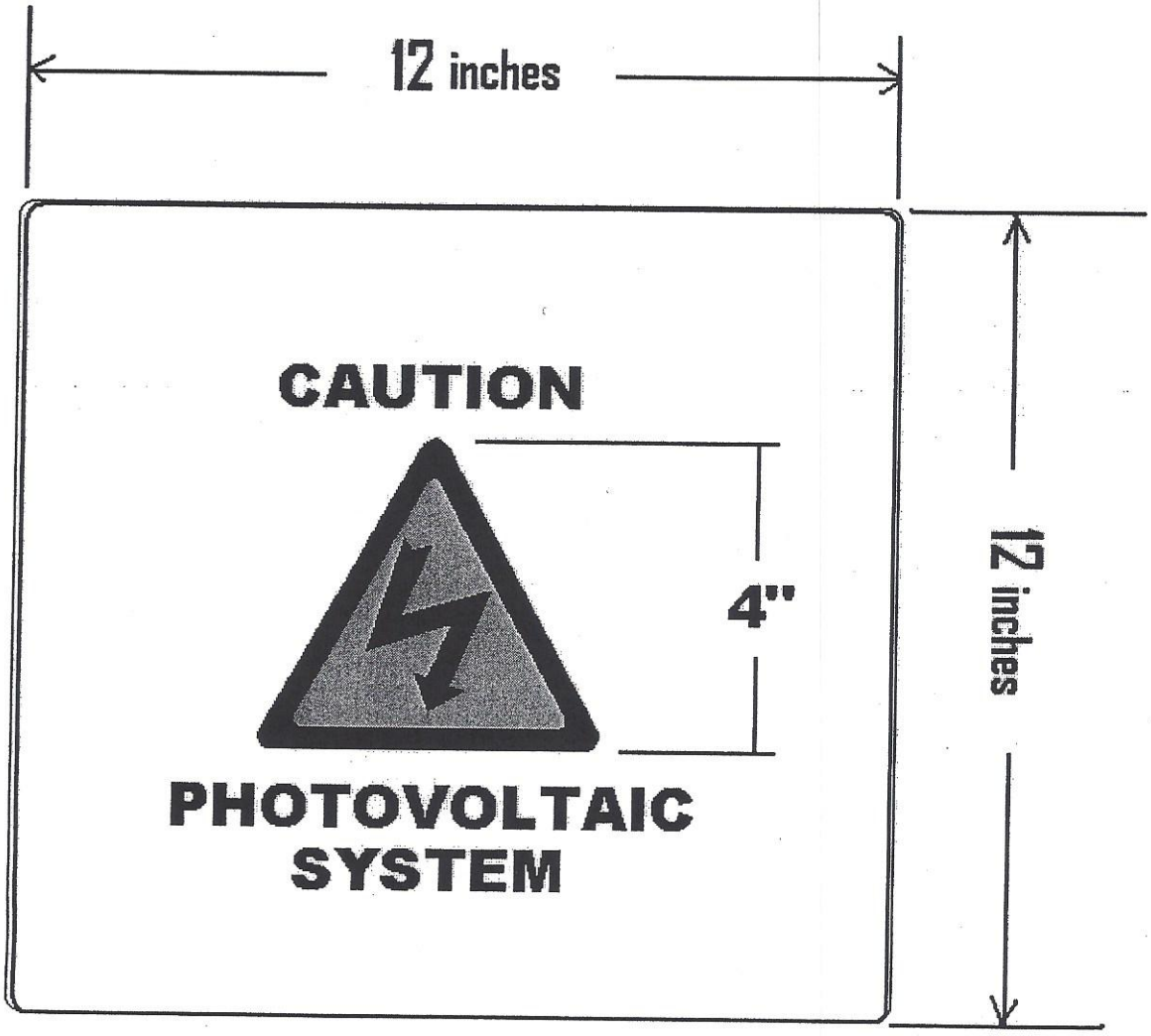


Example 4



SOLAR ARRAY EXAMPLE – SMALL COMMERCIAL

8' WALKWAYS


12 inches
CAUTION
4"
12 inches
PHOTOVOLTAIC
SYSTEM