

Solar America Board for Codes and Standards



WIND LOAD CALCULATIONS FOR PV ARRAYS

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Study Report Overview

This fact sheet summarizes the findings and recommendations for the Solar America Board for Codes and Standards (Solar ABCs) Study Report, *Wind Load Calculations for PV Arrays*.

Today's photovoltaic (PV) industry must rely on licensed structural engineers' interpretations of various building codes and standards to design PV mounting systems able to withstand wind-induced loads. However, the safety and sufficiency of structural attachments for PV arrays are not adequately addressed within any codes or standards. The result is a diversity of code interpretations from different individuals and groups, often yielding different design loads for the same design specifications.

This report provides sample calculations for determining wind loads on PV arrays based on *ASCE Standard 7-05*. The report focuses on application of PV arrays mounted parallel to the roof slope and relatively close (3 to 6 inches) to the roof surface. The report does not address other array configurations or building-integrated PV.

Key Findings

It is necessary to evaluate equipment and attachment methods to ensure that PV equipment will remain attached to structures during windstorm events and that the additional loads or load concentrations produced during these events do not exceed the structural capacity of the building. *ASCE Standard 7-05* is the standard for evaluating wind forces on structures, but it does not provide sufficient guidance to the design professionals and code officials to assess wind loads on PV installations.

This lack of guidance creates obstacles for the PV industry. The resulting problems include frustrated installers, dissatisfied customers, and wind-related structural failures. In addition, uncertainty about what constitutes a safe and secure installation for a given wind load can slow or stop the approval process for PV installations and complicates the training of code officials.

PV modules and arrays present a unique design challenge in high wind regions. Eventually, codes and standards will be updated to address the mounting of PV arrays to rooftops thus eliminating potential barriers to market development in high wind regions.

In the meantime, this report provides design guidance including sample calculations for determining the wind loads on PV arrays based on the recognized methods of *ASCE Standard 7-05*.

Solar ABCs Recommendations

1. Base the structural design of roof-mounted PV systems on the *ASCE Standard 7-05* as follows:
 - a. Section 6.5.12.2, main wind-force resisting system (MWFRS), is the recommended starting point for designing the PV mounting structure, with the PV module oriented above and parallel to the roof surface.



- b. Section 6.5.12.4.1 addresses wind loads on components and cladding. We recommend the use of Section 6.5.12.4.1 and supporting Figures only for the design of the PV module attachment clips and hardware to the structure, and for calculating loads on individual PV modules.
 - c. We do not recommend Section 6.5.15, 6.5.15.1, and Figure 6-21 for the design of PV systems.
 - d. This report provides basic guidance for applying *ASCE Standard 7-05* to existing codes and standards for the typical residential application of PV arrays mounted parallel to the roof slope and relatively close (3 to 6 inches) to the roof surface.
2. Wind tunnel testing for the most common roof-top PV installations should be conducted to verify methods and calculations. The installation types include stand-off mounting parallel to the roof, stand-off mounting at an incline relative to the roof, and ballasted installations on flat roofs.
 3. Codes and standards should be modified to specifically address the mounting of PV arrays to rooftops to eliminate potential barriers to market development in high wind regions.
 4. Local jurisdictions and design professionals use the recommendations in this report to ensure continuity in interpreting existing codes and standards.

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Download the Full Report:

www.solarabcs.org/wind

For more information, visit the Solar ABCs Website:

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A Report from the Solar America Board for Codes and Standards

The Solar America Board for Codes and Standards (Solar ABCs) is a collaborative effort among experts to formally gather and prioritize input from the broad spectrum of solar photovoltaic stakeholders including policy makers, manufacturers, installers, and consumers resulting in coordinated recommendations to codes and standards making bodies for existing and new solar technologies. The U.S. Department of Energy funds Solar ABCs as part of its commitment to facilitate wide-spread adoption of safe, reliable, and cost-effective solar technologies.

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