

# All charged up

NRCA UPDATES ITS  
PV SYSTEMS MANUAL

BY JASON WILEN, AIA, CDT, RRO





In July, NRCA published *NRCA Guidelines for Rooftop-mounted Photovoltaic Systems—Second Edition*, which provides up-to-date NRCA best practices and technical information concerning the design, materials and installation of rooftop-mounted photovoltaic (PV) systems. This edition replaces the first edition manual published in 2015.

## Scope and layout

*NRCA Guidelines for Rooftop-mounted Photovoltaic Systems—Second Edition* explores the basics of commonly installed rooftop PV systems, including the components that make up typical systems and how the systems are installed on roofs. PV systems associated with low- and steep-slope roof assemblies are described, and NRCA's guidance for best practices is presented. Additionally, rooftop PV system-related provisions in current editions of model codes and standards are identified and contextualized.

The manual contains three chapters and three appendixes. Following is a brief summary of each section.

Chapter 1—PV Fundamentals explains the fundamental concepts of rooftop-mounted PV systems. Information about contractor selection for rooftop-mounted PV projects is provided, and the roles of various construction trades involved with the installation of successful rooftop-mounted PV systems are addressed. Recommendations for coordination between roofing contractors and PV component installers also are provided.

As part of the discussion, relevant terms from ASTM E772, “Standard Terminology of Solar Energy Conversion,” are provided, and the basic elements of rooftop PV systems are identified and explained.

Chapter 2—Standards and Codes provides a brief overview of the standards and model codes applicable to rooftop-mounted PV installations and systems. Section 2.1—Standards provides information about standards, and Section 2.2—Codes provides information about model codes relating to rooftop-mounted PV installations.

The following standards are summarized:

- UL 1703, “Standard for Flat-Plate Photovoltaic Modules and Panels”
- UL 1741, “Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources”
- UL 2703, “Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels”
- ASTM D3161, “Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method)”
- ASTM E1038, “Standard Test Method for Determining Resistance of Photovoltaic Modules to Hail by Impact with Propelled Ice Balls”
- IEEE 1547, “IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems”
- FM Approval Standard 4478, “Approval for Rigid Photovoltaic Modules”

In addition, a general description of FM Property Loss Prevention Data Sheets and a summary of FM Property Loss Data Sheet 1-15, “Roof Mounted Solar Photovoltaic Panels,” are included.

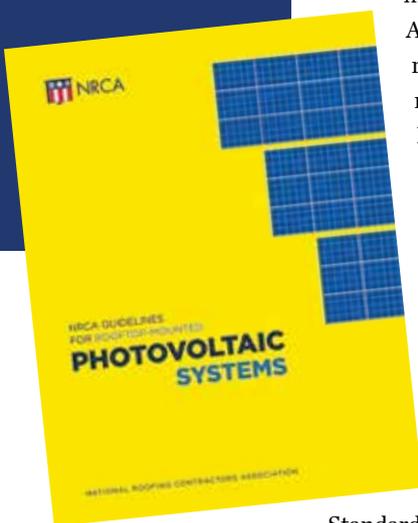
Chapter 2 also contains updated code-compliance information. The following codes are referenced and code text relevant to rooftop PV is provided for:

- *NFPA 70: National Electrical Code,® 2017 Edition* (updated from the 2014 edition)
- *International Building Code,® 2018 Edition* (updated from the 2015 edition)
- *International Residential Code,® 2018 Edition* (updated from the 2015 edition)
- *International Fire Code, 2018 Edition* (updated from the 2015 edition)
- *NFPA 1: Fire Code, 2018 Edition* (updated from the 2015 edition)

## The I-Codes

The International Codes (I-Codes) are a series of model codes promulgated by the International Code Council® that serve as the technical basis for state, county and local adoption of codes regulating the design, construction and operations of buildings. The 2018 editions of the I-Codes contain numerous changes related to rooftop-mounted photo-voltaic systems compared with the 2015 editions.

The changes are explained in a two-part article in *Professional Roofing's* December 2017 and January 2018 issues. "Keeping an eye on I-Codes: Part one" covers relevant changes in the *International Building Code*,® the *International Energy Conservation Code*® and the *International Fire Code*.® "Keeping an eye on I-Codes: Part two" covers relevant changes in the *International Residential Code*® and the *International Existing Building Code*.® To view the articles, go to [www.professionalroofing.net](http://www.professionalroofing.net).



Chapter 3—Rooftop-mounted PV System Applications provides roofing-specific information and NRCA's recommended guidelines applicable to rooftop-mounted PV system installations. Section 3.1—Considerations Applicable to Rooftop-mounted PV System Installations provides important considerations applicable to rooftop-mounted PV system installations on low- and steep-slope roof systems. Section 3.2—Low-slope Rooftop-mounted PV System Applications provides specific information applicable to PV applications on low-slope roof systems. Section 3.3—Steep-slope Rooftop-mounted PV System Applications provides information specific to PV applications on steep-slope roof systems.

The appendixes include rooftop PV system safety guidelines, a list of referenced organizations and unit conversions.

## Notable changes

The manual's second edition contains important updates for installing rooftop PV systems.

## Related codes and standards

As noted, building codes with relevant rooftop PV requirements are provided in Chapter 2 and have been updated to include information from current code editions.

As with the manual's first edition, rooftop-mounted PV systems-related standards are summarized. New to this edition is a discussion of UL 2703, "Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels"; ASTM E1038, "Standard Test Method for Determining Resistance of Photovoltaic Modules to Hail by Impact with Propelled Ice Balls"; FM Approval

Standard 4478, "Approval Standard for Rigid Photovoltaic Modules"; and FM Global Property Loss Data Sheet 1-15, "Roof Mounted Solar Photovoltaic Panels."

## Steep-slope

Steep-slope roof systems generally include water-shedding types of roof coverings installed on slopes exceeding 3:12. Common steep-slope roof system types are asphalt shingles, clay and concrete tiles, metal shingles, wood shakes and shingles, slate, and architectural metal panels. The updated edition contains a new discussion of building-integrated PV components installed on steep-slope roof systems. Rack-mounted, integrated framing and racking, and solar shingle PV systems also are discussed, and rooftop attachment information has been updated.

## Low-slope

Low-slope roof systems generally include water-shedding types of roof coverings installed on slopes at or less than 3:12. Common low-slope roof system types are membrane roof systems, such as built-up roofing, polymer-modified bitumen and single-ply membranes; structural metal panel roof systems; and spray polyurethane foam roof systems. The updated edition includes a new discussion of rack-mounted PV panel systems, as well as systems that use integrated framing and racking. Rooftop attachment information also has been updated.

## Safety appendix

Although rooftop safety is outside the manual's scope, specific safety guidance directly related to rooftop PV system installations is included in a new appendix. General rooftop PV system safety and electrical safety are discussed. *The NRCA Safety Manual, Third Edition*, and *NRCA Toolbox Talks* provide additional information about rooftop safety and are available in the NRCA bookstore at [shop.nrca.net](http://shop.nrca.net).

## Update your library

I encourage you to update your library with NRCA's best practice guidelines for rooftop-mounted PV systems. *NRCA Guidelines for Rooftop-mounted Photovoltaic Systems—Second Edition* is available to NRCA members for free electronically via NRCA's bookstore and the NRCA app. Hard copies also are available for purchase. 📖📱🌐

**JASON WILEN, AIA, CDT, RRO**, is a senior associate for Chicago-based architectural and structural engineering firm Klein & Hoffman Inc. and a former NRCA director of technical services.