



Electrical Connections

For regulatory authorities in the electrical inspection community.



UL Powers Up to Evaluate Photovoltaic Products *by John Taecker*

In the past few years, the number of photovoltaic systems installed in North America has dramatically increased, forcing AHJs to quickly get up to speed on how to properly conduct plan reviews and inspections on these systems. Fortunately, UL has taken the lead in many key safety areas associated with PV systems that will help make the AHJ's job easier. This article highlights some of these areas.

UL's New World-Class Testing Laboratory

UL recently opened North America's largest commercially focused photovoltaic (PV) testing and certification facility in Silicon Valley. Located in San Jose, CA, UL's 20,000 sq. ft. Photovoltaic Technology Center of Excellence increases testing capacity for the renewable energy industry and will enable manufacturers to get UL Listed PV products to market faster. The state-of-the-art lab's 14 test cham-

bers and two solar simulators provide indoor and outdoor testing capabilities to evaluate photovoltaic modules and panels, and a wide variety of power systems accessory equipment. The facility will also be used for research and training.

The global growth rate for PV products has increased 30 percent annually during the last few years, according to available statistics. Photovoltaic equipment is required to be Listed by Article 690 of the National Electrical Code® (NEC®). The code requirements for certification have significantly increased the demand for PV product testing and certification services.

Basing the testing facility in Silicon Valley enables UL to effectively work with the growing community of start-ups and existing companies who are bringing new technology into mainstream solar production. This includes thin-film PV, concentrated solar power and other cell technologies, such as CIGS (copper indium gallium selenide) and CdTe (cadmium telluride). UL's Center of Excellence

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is facilitating increased growth in the essential energy market and supporting broader use of alternative sources.

UL has been a leader in photovoltaics since 1975, when UL became the first third-party testing organization to set in motion a safety certification scheme based on a sequence of environmental and mechanical stress tests for PV products. UL also develops and maintains the industry product safety standards for these products.

Product Safety Standards

The requirements used to evaluate PV products are located in:

- UL 1703, Standard for Safety for Flat-Plate Photovoltaic Modules and Panels,
- UL 1741, Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, and
- Subject 4703, Outline of Investigation for Photovoltaic Wire.

These documents are continually maintained to ensure compliant products are suitable for installation in accordance with Article 690 of the National Electrical Code. UL 1703 requirements are also found in ULC/ORD-C1703-01 for Canada. Requirements for PV wiring connectors are based upon UL 1703 and UL 498 to address the extreme electrical and environmental conditions.

PV Product Categories

Listed flat-plate photovoltaic modules and panels (QIGU — see page 267 of the 2008 UL White Book), such as crystalline silicon or thin-film, are for mounting on buildings or on ground-supported frames. These modules and

panels are intended to be connected to electrical loads, controllers, or to static inverters that convert the dc power that the modules or panels generate to other types of power compatible with the intended loads.

Listed concentrator photovoltaic (CPV) modules and assemblies (QICP — see www.ul.com/database) use lenses and reflectors to concentrate sunlight on photovoltaic cells to increase output power. These products can be self-supporting, mounted on buildings or ground-supported frames. Roof-mounted modules or assemblies of either type are evaluated

for one of three mounting methods: (1) integral to the roof of a building, (2) directly on a building's roof, or (3) on a rack with a space above the roof surface.

UL also evaluates building-integrated photovoltaic modules and panels (QHZZ) and their mounting systems (QHZZQ). See UL Guide Information for both of these product categories on page 266 of the 2008 UL White Book. These products are PV modules and panels intended to serve as (1) the roof, or as a majority component of the roofing system of a building, or (2) a structural or nonstructural component of a building, such as a curtain-wall, facade, atrium, or skylight. More information on these products and systems can be found in the article in the 2007 Issue 4 of The Code Authority newsletter (see www.ul.com/tca/issues/tca_issue_4_2007.pdf).

Distributed generation power systems accessory equipment (QIIO — see page 268 of the 2008 UL White Book) includes utility interconnection controllers, transition boxes, control boxes, connectors, distribution panels, interface modules, and utility-interactive inverters. A new Photovoltaic Wire (ZKLA — see page 385 of the 2008 UL White Book) has been developed to address the specific issues of PV installations.

Additional information on the scope and limitations of these various products, marking information, and information on individual product Listings can be found in UL's Online Certification Directory at www.ul.com/database. Information on UL's PV services can also be found at www.ul.com/dge/photovoltaics. For more information on PV listings, contact Tim Zgonena at +1.847.664.3051 or at Timothy.P.Zgonena@us.ul.com.

