

A New Building Integrated Photovoltaics (BIPV) Standard

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BIPV Safety Evaluations for Conformance

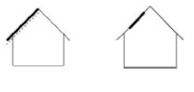
As solar photovoltaic (PV) technology matures, it is increasingly being integrated into building construction and used to replace conventional materials in parts of the building envelope such as roofs, curtain walls and windows. As conventional roof installation costs continue to increase, and PV prices decrease, building integrated photovoltaics (BIPV) are growing in popularity.

Architects are now integrating PV technology into their designs for the aesthetic value and to help building owners reduce energy costs with environmentally-friendly electric generation. BIPV is a way to achieve compliance with energy conservation codes and sustainability requirements and helps in earning a LEED building certification.

What is BIPV?

BIPV are PV modules that are integrated into a building and have been designed following the basic requirements for both photovoltaic products and construction materials, or the components and cladding they are intended to replace. BIPV products are intended for mounting integrally to the structure or protective surfaces of a building in one of two primary installation methods:

- As a roof, or as a major component of the roofing system of a building



- As part of a structural or non-structural component of a building such as a curtain wall, facade, atrium or skylight



BIPV Testing and Certification Requirements

BIPV testing and certification is required by the International Residential Code (IRC) (sections R905.16 and R905.17) and the International Building Code (IBC) (sections 1507.17 and 1507.18) for photovoltaic shingles and BIPV roof panels. Testing and evaluation includes electrical, temperature, mechanical loading, wind resistance, impact and fire tests. The product's output wiring system is also investigated for conformance with the provisions of the National Electrical Code (NEC), including Article 690 Solar Photovoltaic (PV) Systems.

Currently, BIPV systems and their mounting means for roofing systems are evaluated separately for compliance to several standards:

- UL 1703, Standard for Safety of Flat-Plate Photovoltaic Modules and Panels, and
- UL 790, Standard Test Methods for Fire Tests of Roof Coverings, and
- Either ASTM D3161 Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method) or UL 1897, Uplift Tests for Roof Covering Systems.

The results of evaluation to these various requirements may be captured in separate certification reports that must be reviewed to determine compliance with all model code requirements. Having one standard to address all aspects of concern for BIPV safety and code compliance makes it far easier for code authorities to determine compliance with the applicable electrical and building codes.

The recently published UL 7103, Outline of Investigation for Building-Integrated Photovoltaic Roof Coverings, brings together all the testing standards required for BIPV by the model installation codes. UL 7103 includes additional requirements to address concerns regarding these unique products and their specific labeling (marking) requirements.

UL 7103 – The New Standard for BIPV Roofing Products

Safety certification for BIPV products is more stringent than certification for conventional PV modules. The NEC, IBC and IRC require that all PV products installed on or around a building must be certified by a Nationally Recognized Testing Laboratory (NRTL) in accordance with the applicable standards. Because of these model code requirements, all BIPV products are subjected to the same electrical certification, performance and safety testing standards as conventional PV modules and more.

Product installation concerns for PV panel systems include:

- Utility compatibility and interaction
- Environment, e.g., indoor, outdoor, hazardous location, etc.
- Max. number of modules affecting voltage, current and short-circuit
- Fire exposure ratings
- Wind and snow loading
- Mounting and attachment
- Grounding and bonding
- Shading

Since BIPV is designed to directly replace roofing material, a BIPV system must be evaluated not only as a PV module but also as a roofing material with additional model code required testing such as:

- Fire resistance
- Impact testing
- Wind resistance
- Wind driven rain
- Environmental testing for conditions like temperature and humidity

Integration of PV systems into building products and architectural designs is growing. Certification to a single, all-inclusive standard provides a solid foundation upon which to certify BIPV technologies and deliver confidence in the safety and performance of new BIPV products for architects, installers and code authorities.

Roof Integrated



Photo Source: standardindustries.com/solar

Roof Shingle



Photo Source: certainteed.com/solar/

Roof System



Photo Source: tesla.com/solarroof

Code Requirements for UL 7103

At the beginning of 2019 code proposals were submitted to revise the International Building Code (IBC) and the International Residential Code (IRC) to require that BIPV roof coverings be simply listed and labeled in accordance with UL 7103 instead of the codes referencing all the different requirements (i.e. UL 790, UL 1897, ASTM D3161, and UL 1703). In May 2019, the code development committees for the IRC and IBC approved proposals S33-19, Parts I & II. There was full support from NRCA (National Roofing Contractors Association) and SEIA (Solar Energy Industry Association). Unless opposition is submitted during Public Comment by mid-July, these proposals will be ratified by the voting membership in late October, and will be published in the 2021 editions of the IBC and IRC.

The Public Comment Hearing agenda will be posted September 4th, which is when UL can confirm if the approval of these proposals remains unchallenged. A proposal to reference to UL 7103 in the next code cycle for the NEC will also be submitted.

In the next iteration UL intends to address BIPV in other applications such as curtain walls, atriums, and skylights for inclusion in the 2024 editions of the codes. Those applications have completely different code requirements, none of the building codes contain requirements for BIPV in those applications at this time.

Additionally, BIPV is a way of achieving compliance with the International Energy Conservation Code as well as the International Green Construction Code and also has benefits in achieving a LEED Building certification.

Why UL?

Integration of PV systems into building products and architecture designs is growing. UL is deeply involved in codes and standards development and is uniquely positioned as leaders in the building and solar industries to advance the testing and certification of BIPV products into the building envelope.

