



THE CODE AUTHORITY[®]

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Class A, B, and C Roof Ratings

Helpful hints for achieving code compliance

By **Howard Hopper** / Regulatory Services Program Coordinator

Questions often arise about the construction needed to achieve a Class A, B, or C fire rating for a roof assembly. The information needed to achieve code compliant installations is included below.

What are these ratings?

The UL 790 (ASTM E 108) *Standard Test Methods for Fire Tests of Roof Coverings* covers the fire resistance performance of roof coverings exposed to simulated fire sources originating from outside a building on which the coverings are installed. They

are applicable to roof coverings intended for installation on either combustible or noncombustible decks.

This standard includes three classes of fire exposure:

- Class A roof coverings, which are effective against severe fire test exposures
- Class B roof coverings, which are effective against moderate fire test exposures
- Class C roof coverings, which are effective against light fire test exposures.

Under such exposures, the roof coverings afford a degree of fire protection to the roof deck, do not slip from position, and are not expected to produce flying brands.

What ratings are required by codes?

There are several requirements for roof covering fire classifications in model codes and city and county ordinances. These requirements are dependent on the type of building construction and the location of the building. Some jurisdictions, due to the

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UL-ese

Definitions of terms frequently used at UL

GUIDE INFORMATION

Descriptive information for each product category that appears in UL's Online Certifications Directory (www.ul.com/database). The Guide Information outlines the scope and limitations of UL's certification of a particular set of products, the requirements utilized to evaluate those products, and the UL Mark appearing on those products.



Facing A Brave New (and Green) World

Managing Editor's Column / by Howard Hopper

Like many of you, I have years of experience working with specific codes. In my case these include building, fire and life safety codes. Historically, the purpose of the codes has been to safeguard life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters during emergency operations.

But society is moving forward, and the scope of our codes is expanding. There is an increasing focus among architects, code authorities and other stakeholders in the built environment on providing installations that also address environmental, sustainability and occupant health requirements. Codes and regulations are moving forward to embrace sustainability and environmental requirements, and it is important for all of us to keep up with these developments so we aren't left behind.

I am proud that UL is actively involved in these areas, primarily through our sustainability and environmental testing, certification and claim validation programs. We recently launched the Code Authorities Sustainability page to assist architects, contractors and code authorities in locating UL environmental and sustainability programs. Check it out by visiting www.ul.com/codeauthorities, and clicking on the "Sustainability" link. If you have any questions about how UL Environment programs can help your jurisdiction, please contact Josh Jacobs at Josh.Jacobs@ul.com.

The Underlying Truth About Roofing Underlayments

By *Alpesh Patel / Staff Engineer, and Dwayne Sloan / PDE Manager*

A roof is an important element of a building's construction. When properly designed and installed it can provide years of protection against the elements, including fire, rain, snow, ice and high winds.

UL has decades of experience testing and certifying roofing systems and materials for resisting fire, high wind impact and other environmental conditions. UL's distinct testing processes clearly demonstrate the importance that roof underlayment plays in complying with these requirements.

Building and residential codes contain comprehensive requirements for roof construction, including specifications for roofing materials used as underlayments. These codes also require certain roof assemblies and materials to be either listed or constructed of materials complying with specific product standards.

Although these codes do not expressly require listing and labelling of roofing underlayments, these products play a critical role in achieving Class A, B, or C fire classification of roof assemblies.

The Standard Test Methods for Fire Tests of Roof Coverings, UL 790 (ASTM E 108), includes three key tests to provide fire classification of roof covering materials and systems. These are the Spread of Flame Test, Intermittent Flame Test, and Burning Brand Test. During the Burning Brand Test heat is transferred directly through the shingles or tiles as well as the roof underlayment, both of which protect the plywood deck. In most Burning Brand Tests conducted over a combustible deck (3/8- or 15/32-inch plywood), the underlayment plays a significant role in achieving the fire rating of the overall roofing system. Accordingly, many certifications of roof covering materials describe the specific types of

underlayments to be used based on the testing conducted. These underlayments are certified under the Prepared Roofing Accessories category (TGDY), which can be found in the UL Online Certifications Directory at www.ul.com/database.

In turn, the individual underlayment certifications specify the types of roof coverings that can be used to achieve the desired fire classification ratings.

There is a common misconception that the UL 790 fire classification rating is only based on the roof covering shingle or tile (e.g. asphalt glass mat, metal, concrete, clay, etc.), and therefore the underlayment is not considered to be a critical component. Based on this misconception, some non-certified roofing underlayments are often used that have not been adequately evaluated for the application. Use of the appropriate roofing underlayments certified under the category Prepared Roofing Accessories (TGDY) and bearing the UL Mark provides confidence that the roof covering and underlayment combination satisfies the code-mandated fire performance requirements.

In addition, depending on the intended applications, codes may require roofing underlayments to comply with a specific product standard, such as ASTM D 226, *Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and*



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PHOTOVOLTAIC SYSTEMS

Achieving code compliant installations using UL Certified products

By *John Taecker / Senior Regulatory Engineer*

Code authorities are seeing an increasing number of photovoltaic (PV) system installations in their jurisdictions. Fortunately, building and residential code requirements have been developed to provide installation criteria while UL certification of PV panels and equipment address the product safety concerns.

This article focuses on installation considerations associated with PV requirements in the 2012 International Building Code (IBC). Many of its points are also applicable to the 2012 International Residential Code (IRC). It also discusses changes to the 2015 IBC flame classification requirements for PV installations.

Rooftop PV system requirements

IBC Section 1509.7 covers the overall design of rooftop PV systems and requires the following:

- A. The installation must comply with Chapter 16 wind load requirements
- B. The PV panels must have the same fire classification as the roof assembly on which they are mounted
- C. The system must be installed in accordance with the manufacturer's installation instructions
- D. The PV panels and modules must be listed and labeled in accordance with the UL 1703 Standard for Safety for Flat-Plate Photovoltaic Modules and Panels.

Photovoltaic panels certified in accordance with UL 1703 can be found in the UL Online Certifications Directory (www.ul.com/database) under the Photovoltaic Modules and Panels product category (QIGU). PV panels complying with UL 790

flame classes are marked Class A, Class B, or Class C, and those that have not been shown to comply with these flame classes are marked "Not Fire Rated".

Photovoltaic modules/shingles

Photovoltaic modules/shingles (also known as building integrated photovoltaics or BIPV) are defined in the IBC as a roof covering composed of flat-plate photovoltaic modules fabricated in sheets that resemble three-tab composite shingles. The installation of photovoltaic modules/shingles is covered by IBC Section 1507.17, which includes similar requirements to the rooftop PV system requirements described above. This includes requiring the photovoltaic modules/shingles to be listed and labeled in accordance with UL 1703. In addition, these products also must bear a label showing compliance with ASTM D 3161 wind resistance requirements.

Classifications for these PV modules/shingles are covered under the product categories Prepared Roof-covering Materials, Formed or Molded Metal, Fiber-Cement, Plastic or Fire-retardant-treated Wood (TFXX) and Building-integrated Photovoltaic Modules and Panels (QHZZ). Products complying with UL 790 are marked Class A, Class B, or Class C, and those that have not been shown to comply are marked "Not Fire Rated".

IBC Section 1505.8 reinforces the previously cited flame classifications and requires

rooftop installed PV panels and modules, whether they are adhered or attached to the roof covering, or are photovoltaic modules/shingles to be labeled to identify their fire classification (e.g. Class A, B, or C).

External fire exposure considerations

A key objective of the IBC PV fire classification requirements is to verify that the installation of PV does not diminish the minimum fire safety requirements of the roof. IBC Section 1505 requires that roof assemblies meet the UL 790 Class A, B, or C fire performance based on the type of construction of the building on which they are utilized. UL 790 evaluates the ability of the roof assembly to resist a simulated fire source originating from outside the building on which the roof coverings are installed. These ratings are based on the ability to prevent a fire from penetrating through the roof and the ability to minimize the spread of a fire along the roof surface.

In the absence of a PV *system* fire classification, it may seem appropriate to substitute the PV *module* fire classification rating in order to achieve the desired result, which is the preservation of the roof assembly's original fire classification. However, simply using the PV module fire classification rating may not provide the desired protection against external fire exposure in many cases.

With funding from the U.S. Department of Energy, UL and the Solar America Board for Codes and Standards (Solar ABCs) developed a test plan to investigate the fire resistance properties of PV panels supported on standoff mounted racks configurations. Rigorous testing revealed that the performance of a *system* (which includes PV modules on standoff mounted racks) exposed to fire or flame is not the same as that of a *module* alone.

The results of these tests show that actual performance of a rack-mounted PV system exposed to fire or flame is strongly dependent on the mounting geometry of the PV array and properties of the components that make up the specific PV module type. However, the results are not necessarily dependent on the fire classification rating of the module. The fire classification rating of the PV module is not a good predictor of the fire classification rating of the PV module, mounting hardware, and roof as a system. A summary of this research is published in a Solar ABCs report available at www.solarabcs.org/about/publications/reports/flammability-testing/index.html.

New fire testing requirements

As a result of this testing, and in consideration of the IBC external fire protection requirements, a working group composed of representatives from the PV industry, the roofing industry, standards development organizations, the building and fire enforcement community, and government laboratory experts developed a new test methodology to determine fire classification ratings for PV systems. The new test methodology was adopted by the UL 1703 Standard Technical Panel, and was published October 25, 2013. These requirements are reflected in the 2015 IBC.

The new fire classification procedure, which becomes effective in 2016, requires the following tests be performed to derive a fire classification rating for the PV system



(i.e. PV module with mounting systems in combination with roof coverings):

- Spread of flame test on the top surface of module or panel
- Spread of flame test at roof and module or panel interface over representative steep or low sloped roof
- Burning Brand Test on module surface over representative steep sloped roof
- Burning Brand Test between the module or panel and representative steep sloped roof.

Classifications for these roof-top PV systems are covered under Mounting Systems, Mounting Devices, Clamping Devices and Ground Lugs for Use with Photovoltaic Modules and Panels (QIMS). PV mounting systems tested to the new requirements are marked Class A, Class B, or Class C to indicate

their resistance to external fire exposure when installed in combination with specific PV modules and according to the PV mounting system installation instructions.

The specifications for the assembly, materials and components should be carefully evaluated at the job site to verify the PV system and roof assembly are built in accordance with the UL design, construction or product certification. Code authorities should pay special attention to ensuring that materials required to be UL Certified have the appropriate ratings and UL Marks.

For additional information on photovoltaics, please contact John Taecker in Santa Jose, Calif., at John.K.Taecker@ul.com or at +1.408.754.6658.



Class A, B, and C Roof Ratings (continued from cover)

history of fire incidents or because of their location, have increased the minimum fire classification requirements in the IBC.

For example, the IBC requires roof coverings on Type IA, IB, and IIA buildings to have a minimum Class B rating. In comparison, buildings required by the International Wildland-Urban Interface Code to be provided with Class 1 ignition-resistant construction are required to include Class A roof assemblies. It is up to the designer to determine the minimum roof assembly fire classification for a given building, based on locally enforced requirements.

Can ratings be interchanged?

To obtain a UL 790 fire classification, roof assemblies are required to pass a series of exterior fire exposure tests – the Class A tests are more severe than the Class B tests,

which are more severe than the Class C tests. Accordingly, Class A roof assemblies are suitable for use where Class A, Class B or Class C roofs are required, and Class B roof assemblies are suitable for use where Class B or Class C roofs are required. Unrated roof assemblies are not suitable for use in any applications requiring a Class A, B or C rating, except when specified in a code.

Where can these roof certifications be found?

UL has a wide range of roof related certifications, but only the following categories include products evaluated for Class A, B, and C ratings:

- Roofing Systems (TGFU)
- Prepared Roof-covering Materials (TFWZ)
- Prepared Roof-covering Materials, Formed or Molded Metal, Fiber-Cement, Plastic or

- Fire-retardant-treated Wood (TFXX)
- Prepared Roofing Accessories (TGDY)
- Building-integrated Photovoltaic Modules and Panels (QHZZ)

Information on these product categories and the manufacturers' certifications can be found in the UL Online Certifications Directory at www.ul.com/database.

How are these systems to be constructed to achieve the desired rating?

Let's focus on two of the above categories to answer this question, since the other categories have similar installation considerations.

Prepared roof-covering materials include products such as asphalt or glass-fiber shingles. These materials are intended



to be installed on combustible decks (3/4-inch thick wood sheathing boards or 3/4-inch thick plywood unless otherwise indicated in the installation instructions). If the installation instructions specifies a 1/2-inch thick (minimum) plywood, then 15/32-inch thick plywood or 3/8-inch thick (minimum) nonveneer PS-2 rated sheathing (oriented strandboard panels, structural particleboard panels, composite panels or waferboard panels) are suitable alternatives when a certified underlayment is utilized between the sheathing and the prepared roof covering.

Roofing systems consist of a combination of materials intended to be installed on combustible or noncombustible decks in accordance with detailed instructions included with the packages, and as described in the UL certification.

The details for the manufacturers' system typically include the following information:

- The UL 790 classification (e.g. Class A, B, or C)
- The deck construction supporting the roofing system (combustible or noncombustible)
- Any restrictions on the roof incline
- Required (or optional if so indicated) barrier boards, ply sheets, and surfacing.

The Guide Information for Roofing systems describes specific details for permissible combustible or noncombustible deck constructions.

The roofing system category covers a wide range of roofing systems, including those with metal panels, hot asphalt or coal tar felt, fluid-applied coatings, single-ply membrane, spray-applied foam and coating, and photovoltaic modules among others.

What documentation should be consulted to determine construction details and ratings?

Many architects and contractors attach the UL certification and product category guide information from the UL Online Certifications Directory www.ul.com/database to their plan review packages, along with the manufacturer's instructions. It is also helpful to have this information available at the job site for reference by the contractors and code authorities inspecting the installation.

For more information on UL 790 roofing certifications please contact Dwayne Sloan in Research Triangle Park, NC., at Dwayne.E.Sloan@ul.com or at +1.919.549.1676.

Roofing Underlayments (continued from page 3)

Waterproofing, Type I; ASTM D 4869, Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing, Type I; or ASTM D 6757, Standard Specification for Underlayment Felt Containing Inorganic Fibers Used in Steep-Slope Roofing. UL certified underlayment products investigated to these standards are clearly identified by a UL

Mark on the roll, package or container. This provides confidence that the underlayment satisfies the required code requirements.

For more information on roofing underlayment certifications please contact Alpesh Patel in Northbrook, Ill., at Alpesh.Patel@ul.com or at +1. 847.664.2522.

Electrical Circuit Integrity System Update

UL recently certified four fire-resistive cable systems, including metal sheathed cable and cable in conduit systems. These are designated as **System No. 1850**, **System No. 120**, **System No. 25A** and **FPL in EMT System No. 28A**. Details on these two-hour fire-resistance rated systems can be found in the UL Online Certifications Directory under the Electrical Circuit Integrity System (**FHIT**) product category. These systems are intended to be used in pathway survivability applications, such as those described by the NFPA 72 National Fire Alarm Code, when conductors used for transmitting system information are required to remain operational during fire conditions.

These certifications were achieved under a program that was developed as a result of research into concerns with previously certified cables. The program also reflected the work of a joint U.S. and Canada standards working group that was formed to determine the upgrades in requirements, and to deliver a single, harmonized bi-national standard.

For more information on fire-resistive cable, circuit integrity cable or electrical circuit integrity systems, please contact Blake Shugarman in Northbrook, Ill., at Blake.M.Shugarman@UL.com or at +1.847.664.2022.



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Calendar of Events

April 27 – May 4, 2014

ICC Committee Action Hearing
 (Group C Codes)
 Memphis, Tenn.
www.iccsafe.org/

June 9 – 12, 2014

NFPA Conference and Expo
 Las Vegas, Nev.
www.nfpa.org

June 22 – 24, 2014

BOMA Every Building
 Conference and Expo
 Orlando, Fla.
www.boma.org/

June 26 – 28, 2014

AIA 2014 Convention
 Chicago, Ill.
www.aia.org/

To include your upcoming events, email Howard Hopper at Howard.D.Hopper@ul.com. Please add “TCA Calendar” in the subject line.

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 Department. Available to assist code
 authorities.

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