Requirements for Photovoltaic Modules Tested under Fire Conditions According to IEC 61730-2

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IEC 61730 describes both the requirements for materials and components, such as e.g. foils, frame materials, junction boxes, etc., and for complete PV modules.

The fire resistance requirements of IEC 61730-2 for PV modules are based on the American fire tests for roof coverings according to ANSI/UL 790. Furthermore additional country-specific requirements can result from the respective construction regulations.

The

- **Spread of Flame Test** and the
- **Burning Brand Test**

are to be performed for the fire resistance qualification of PV modules in the roof area. For this purpose both roof-integrated PV modules and also modules for roof parallel installation are subjected to flame treatment from the upper surface.

The PV modules are rated in Classes A, B or C, whereby Class C comprises the minimum requirements. The requirements of roof-integrated PV modules can go beyond these requirements and are orientated at the fire resistance requirements of the roof in which the PV modules are installed.

The fire resistance qualification of PV modules within the framework of the IEC-certification at TÜV Rheinland requires at least four PV modules of each class for testing. Depending on the fire behaviour and the dimensions of the PV modules this number may also be higher.

TÜV Rheinland Energie und Umwelt GmbH subcontract performance of the fire tests to their cooperation partner, the fire technology division of CURRENTA GmbH & Co. OHG in Leverkusen.
Spread of Flame Test

The aim of the Spread of Flame Test is to evaluate the flame spread on the upper surface and, as applicable, between the roof covering and the PV modules assembled on the roof. For this purpose a gas flame is directed over the surface of the PV elements and exposed to wind. Flame exposure period and burner rating are graduated according to the requirements:

- **Class C**
  - Burner rating approx. 325 kW
  - Flame exposure period 4 min

- **Class A or B**
  - Burner rating ca. 378 kW
  - Flame exposure period 10 min

A total of three modules are required for the Spread of Flame test. The modules are tested both individually and also parallel as pairs. In this way also a potential gap between two module or frame components and gaskets can be evaluated under fire test conditions. The test modules are mounted on the test rig in accordance to the installation manual of the manufacturer with the required mounting and attachment parts.

Picture 1: Spread of Flame Test
**Burning Brand Test**

The *Burning Brand Test* evaluates whether an external fire can cause the test specimen to also burn or to even burn through. For this purpose, depending on the class to be tested, wooden brands with a mass of 10 g to 2.000 g are deployed as the incendiary composition. These brands are inflamed and placed on a PV module assembled on the test rig where they are secured against slipping off. Testing is also performed under wind exposure.

The class rating in A, B und C is based on the different masses of the wooden brands and the number of individual tests.

![Picture 2: Wooden brands according to UL 790, Class A, B, C](image)

**Requirements from IEC 61730-2 and ANSI/UL 1703:**

All criteria for evaluation of the test results in accordance with IEC 61730-2 apply to both the *Spread of Flame Test* and to the *Burning Brand Test*.

The principal requirements in accordance with IEC 61730-2 are that:

- No glowing or burning part of the PV modules may fall from the test rig.
- The flame spread may not exceed the following:
  - Class A – 1.82 m
  - Class B – 2.40 m
  - Class C – 3.90 m
- The lateral flame spread is limited.
In the North American standard ANSI/UL 1703 additional requirements for PV modules are imposed which are derived from UL 790, according to which the following are not permitted:

- that burn-through results with the formation of holes in the PV modules.
- that the PV modules also burn continuously during the *Burning Brand Test*. 