0239-L-21/9
16 June 2023

Additional test report

Allshield Blue 2C coating + EKLTM 800 /
450 reinforcement / Eco Prim Grip primer / Cosmofin FG /
Fisprofi 5,0 × 120 mm fastener + Ø 70 metal washer /
Unidek Platinum Kameleon / trapezoidal steel deck

kiwa

Trust
Quality
Progress

BDA TESTING

Testing institute for the building envelope

expertise in façades and roofs

0239-L-21/9
16 June 2023

Additional test report

Allshield Blue 2C coating + EKLTM 800 /
450 reinforcement / Eco Prim Grip primer / Cosmofin FG /
Fisprofi 5,0 × 120 mm fastener + Ø 70 metal washer /
Unidek Platinum Kameleon / trapezoidal steel deck

Kiwa BDA Testing B.V.
Avelingen West 35-37
P.O. Box 389
4200 AJ Gorinchem
The Netherlands

Tel. +31 183 669 690
testing@bda.nl
www.kiwabda.nl

Commercial register Registered by Chamber of Commerce
Midden Nederland 23059445

Details

Principal	Allshield Coatings B.V. Hoogeveenenweg 29 NL-2913 LV NIEUWERKERK A/D IJSSEL
Contact person	K.D.K. Leendertse
Email	kl@allshieldcoatings.com
Date of order	3 November 2021
Project number	0239-L-21/9
Author	A.R. Hameete
Subject	test on external fire exposure to roofs in combination with photovoltaic (PV) arrays according to the principles of CLC/TR 50670

This test report is additional to the original test report issued as order number 0239-L-21/6 dated 21 December 2021. The original test report remains valid and has not been replaced by this additional test report.

Contents

1 Introduction

By order of Allshield Coatings B.V, Kiwa BDA Testing B.V. has determined the fire behaviour of the below mentioned buildup with a realistic PV panel array positioned on top of the roof. The roof has been exposed to external fire exposure according to the principles of CLC/TR 50670:2016.

The aim of this investigation was to determine the fire spread on the surface and downwards on the roof waterproofing system when a burner is placed between the surface of the roof and the PV panel array and ignited.

The roof waterproofing system has been built up as follows:

- substructure of a **trapezoidal steel deck VD 106R/750**;
- thermal insulation, **Unidek Platinum Kameleon**;
- mechanically fastened two layer roof waterproofing system with a top layer of **three different types of Allshield Blue 2C coating + EKLTM 800/450 reinforcement** and a mechanically fastened underlayer of **Cosmofin FG** roof waterproofing sheet in combination with a **Fisprofi 5,0 × 120 mm fastener + Ø 70 metal washer** fastening system.

The roof waterproofing system has been tested including four CS6K-27P5 PV modules from Canadian Solar in combination with an Esdec Wave mounting system of Esdec B.V. in east-west configuration.

This product has not been retested. This additional test report is no technical review of the original test report issued as order number 0239-L-21/6, dated 21 December 2021. The original test report remains valid and has not been replaced by this additional test report.

2 Test specimens

On 27 and 28 September 2021 the test specimens have been built up by members of AllShield Coating B.V. and supervised by Troned.

According to the prescription of the principal the test specimens, with dimensions 6000 mm × 6000 mm, have been built using the following products from the bottom up.

Substructure
- Trapezoidal steel deck, VD 106R/750, mass 9,81 kg.m^{-2}, steel quality S320GD; measured overall thickness: 0,75 mm.

Thermal insulation
- Unidek Platinum Kameleon, production code: not revealed, insulation boards made of EPS, dimensions: 1200 mm × 1000 mm, thickness: 100 mm, mechanically fastened with one fastener per board.

Roof waterproofing sheet (underlayer)
- Cosmofin FG, a polyester fleece reinforced PVC roof waterproofing sheet, thickness: 1,2 mm, width of the sheet: 1006 mm, production code: not revealed.
- The spacing between the individual fasteners has been set at 0,25 m.
- The spacing between the rows of fasteners has been set at 0,96 m.
- The joint has been welded with hot air, using a hand-held welding gun.
- The nominal width of the overlap is 100 mm.

Fastening system
- Roofing screw: Fisprofi 5,0 × 120 mm fastener, production code: not revealed.
- Metal washer: Fisprofi Ø 70 metal washer, production code: not revealed.

Primer
- Eco Prim Grip primer, production code: not revealed; applied with a paint roller.

Coating (top layer)
- Allshield Blue 2C coating + EKLTM 800/450 reinforcement, production code: not revealed; applied with special applying equipment.

Mounting system
- Esdec Wave east-west configuration.

PV modules
- PV module type CS6K-27P5 from Canadian Solar, dimensions 1650 mm × 992 mm.

3 Investigation

3.1 General information

The investigation has been performed in accordance with the principles of CLC/TR 50670:2016 – External fire exposure to roofs in combination with photovoltaic (PV) arrays – Test method(s).

The test has been performed on a realistic roof waterproofing system as mentioned in chapter 2, including a substructure, thermal insulation, a roof waterproofing sheet and PV panel arrays in East / West configuration, consisting of four PV modules (see photo 1 in annex I and figure 2 in chapter 3.2).

The test has been performed by Mr C.W. van der Meijden MCs of Kiwa BDA at Twente Safety Campus in Enschede on 30 September 2021, and was witnessed by representatives of AllShield Coatings B.V. and Troned.

During and after the test the temperatures have been measured with thermocouples which have been positioned on several positions halfway the thickness of the insulation and underneath the insulation above the steel deck. From these measurements graphs have been made. The positions of the sensors are shown on the drawing in annex III

The fire spread on top of the surface has been measured by Kiwa BDA Testing B.V. The temperature measurements have been performed by Troned. The results of the temperature measurements during and after the test have been made available by Troned afterwards.

During the test the average wind speed was approximately the 1 $m.s^{-1}$. Because the wind direction changed during the test, no wind direction can be given.

At the start of the test the ambient temperature was 22,5 °C. The temperature was 18,6 °C in the middle of the insulation and 15,4 °C on the steel roof deck.

After the test the thickness of the coating has been measured at seven random chosen positions of the test specimen.

3.2 Test procedures

As defined in CLC 50670:2015, the gas burner was adjusted to provide a flow rate of (324 ± 20) mg.s^{-1}, generating a heat output of (15 ± 1) kW. After 10 minutes the gas flow has been shut down.

The gas burner has been made of a stainless tube with an external diameter of (15,0 ± 0,1) mm and an internal diameter of (13,0 ± 0,1) mm, ending in a square part with 265 mm side length. In the square part of the burner, 32 holes with a diameter of 1,3 mm have been drilled, 8 holes at each side. The holes have been oriented to the inside of the burner. Half of the holes have an upward inclination of 45° and half of the holes have a downward inclination of 45° with respect to the burner plane.
The gas supplied to the burner has been propane with a purity of 95% or higher.
The propane mass flow rate has been (324 ± 20) mg.s^{-1}, generating a heat output of (15 ± 1) kW. A mass flow controller has been used to ensure that the flow rate is maintained throughout the test.

The gas burner has been applied at lowest edge of the PV module between the backside of the module (exposed surface) and the top of the roofing system surface, centred in the module's width and placed at a distance of d2 = 120 mm from the lowest edge of the module. The burner has been positioned in parallel to the roofing system, with a distance of d1 = 80 mm measured from the underside of the burner to the test deck surface.
The PV module has been installed with an inclination of 13° to the test deck.
The slope of the simulated roof deck (test deck) has been set at 0°.

Figure 1 – Position of the burner according CLC/TR 50670:2016

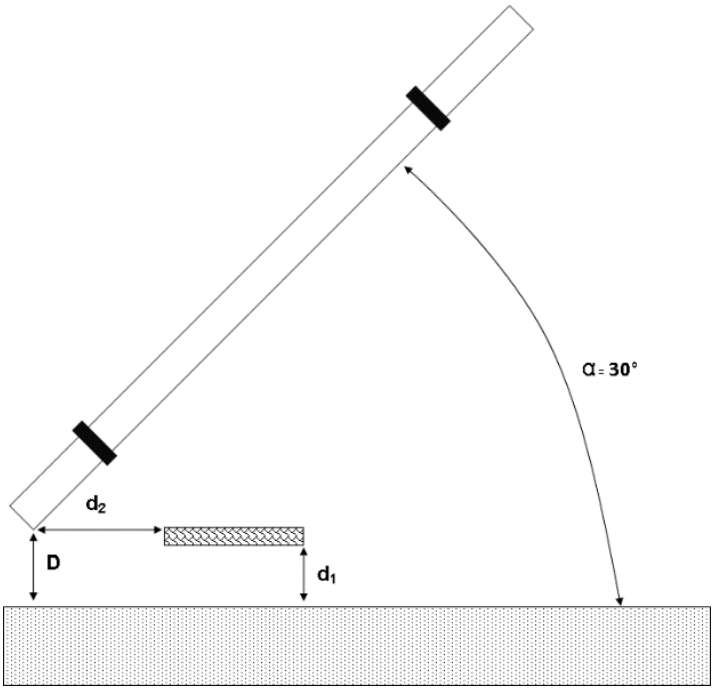
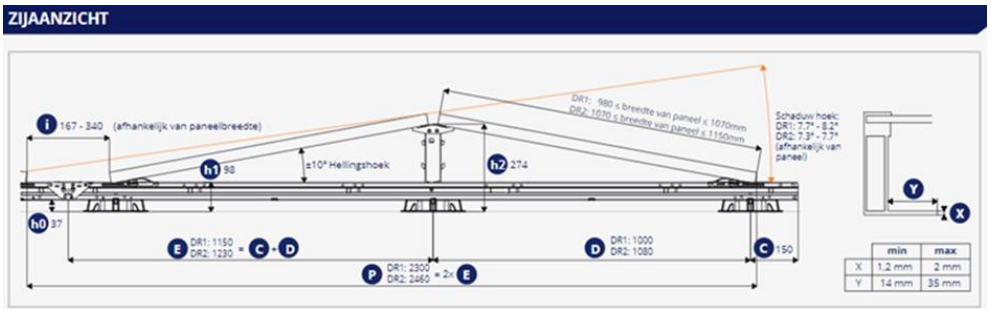
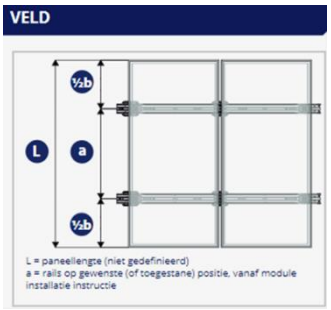


Figure 2 and 3 – East/West configuration Esdec





During and/or after the test the following parameters are observed, measured and recorded.

3.3 External fire spread

- The time when the sustained flaming has progressed left, every 200 mm until the edge of the test specimen. Measured from the left side (seen from the side from which the burner has been positioned) of the projection of the gas burner on to the exposed specimen surface.
- The time when the sustained flaming has progressed right, every 200 mm until the edge of the test specimen. Measured from the right side (seen from the side from which the burner has been positioned) of the projection of the gas burner on to the exposed specimen surface.
- The time when the sustained flaming has progressed forward , every 200 mm until the edge of the test specimen. Measured from the front side (seen from the side from which the burner has been positioned) of the projection of the gas burner on to the exposed specimen surface.
- The time when the sustained flaming has progressed backward , every 200 mm until the edge of the test specimen. Measured from the rear side (seen from the side from which the burner has been positioned) of the projection of the gas burner on to the exposed specimen surface.

In annex I a photo report of the test and the test results is given.

4 Results

4.1 Fire behaviour during the test, measured by Kiwa BDA Testing B.V.

Description	Result [min:s]			
Roofing burning	3:30 [1]			
Burner turned of	10:00			
Fire spread [mm] [2]	**left**	**right**	**forward**	**backward**
▪ 200	- [3]	- [3]	- [3]	- [3]
▪ 400	- [3]	- [3]	- [3]	- [3]

[1] The roofing did not catch fire; this time refers to the PV module.
[2] Length of fire spread measured from the edge the projection of the gas burner on to the exposed specimen surface.
[3] Not been reached.

4.2 Measurements made after the test, measured by Kiwa BDA Testing B.V.

Description	Results
External fire spread / burnt length [1]	
▪ left	0 mm
▪ right	0 mm
▪ forward	0 mm
▪ backward	0 mm

[1] Length of fire spread and damaged area measured from the edge the projection of the gas burner on to the exposed specimen surface.

4.3 Thickness measuments, measured by Kiwa BDA Testing B.V.

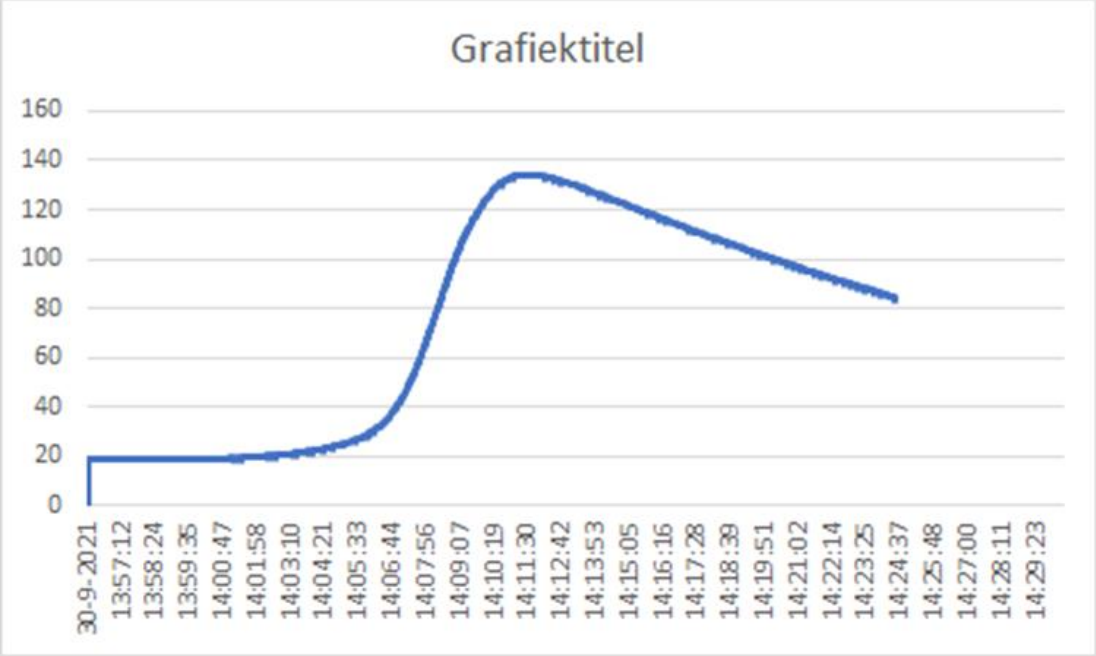
Measurement	thickness [mm]
1	1,47
2	0,70
3	3,11
4	7,87
5	4,49
6	7,76
7	3,97
Mean	**4,20**

4.4 Temperature measurements, measured by Troned

4.4.1 Temperature rising during the test at the position under the burner

Highest temperature measured after	Results (sensor)	
	halfway insulation	underneath insulation
Start of the test	18,6 °C (3)	15,4 °C (25)
5 minutes	19,3 °C (3)	15,7 °C (25)
10 minutes	29,7 °C (3)	15,7 °C (25)
15 minutes	133,5 °C (3)	15,7 °C (25)
20 minutes	117,7 °C (3)	16,2 °C (25)
25 minutes	97,0 °C (3)	16,7 °C (25)
30 minutes	84,3 °C (3)	17,1 °C (25)

4.4.2 Graph of temperature rise during the test in K



5 Discussion

The coating did not catch fire so there was no spread of fire on the surface of the test specimen.

The burner has been turned off after 10:00 (min:s); the flames were directly gone. After 15 minutes the temperature has reached 135 °C in the middle of the insulation, after this time the temperature decreased.

For this investigation a burner has been used as defined in CLC/TR 50670.
The burner has been positioned below one of the PV panels in order to combine the effects of burning of the PV panels with the effects of the fire performance of roofs.

Remarks:

The results are only related to the investigated samples, products and/or systems. Kiwa BDA Testing B.V. is not liable for interpretations or conclusions that are made in consequence of the results obtained.

The uncertainty of measurement is given in annex III.

If sampling was not performed by Kiwa BDA Testing B.V., no judgement can be given with regard to the origin and representativeness of the samples.

This report may only be reproduced in full. Extracts or abridgements shall not be published without permission of Kiwa BDA Testing B.V.

Gorinchem, 16 June 2023
The laboratory

A.R. Hameete
operational manager

Kiwa BDA Testing B.V.

N.W.J. Haanappel BSc
manager testing

Designated as Notified Body NB 1640 pursuant to the Construction Products Regulation (EU, No 305/2011)

Member

I Photo report of the test

Photo 1
The PV modules have been positioned on the test specimen.

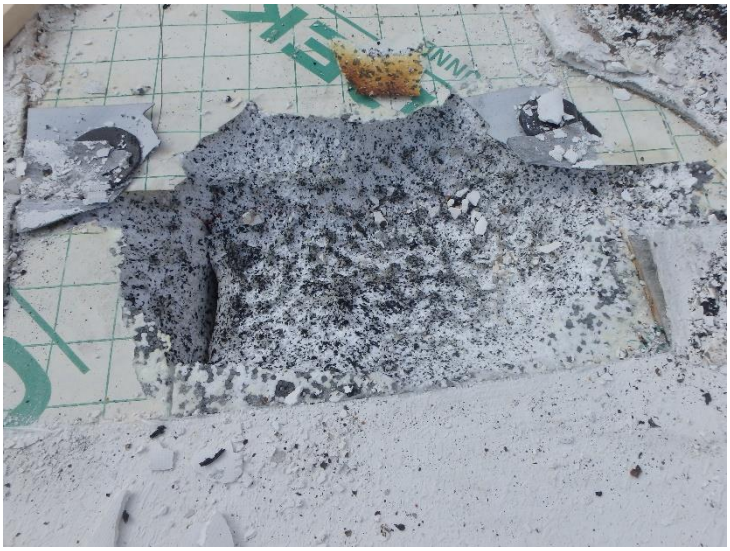
Photo 2
The gas burner has been ignited.

Photo 3
The PV module is burning.

Photo 4
The burner is turned off.

Photo 5
Overview of the damaged area of the coating.

Photo 6
Overview of the damaged area of the thermal insulation.



II Positions of the thermocouples and burner