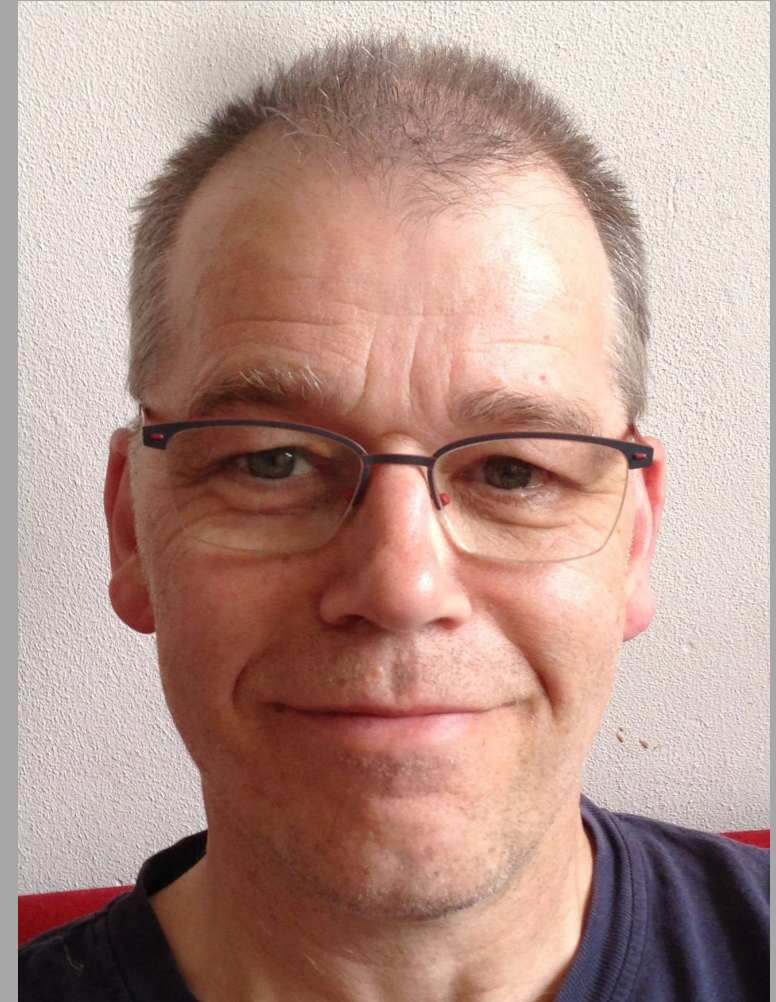


Development of standard for (BI)PV in NL

Peter van de Leur

SFPE Benelux chapter president

- TU Delft, M.Sc. Applied Physics (1983)
- TU Delft, Researcher (1983)
- TNO Centre for Fire Research (1988)
- DGMR (2002)
 - Risk Based fire protection
 - Large compartments
 - Energy transition issues: alternative energy Car Parks, PV
 - Software tools: evacuation, heat transfer



Safety of (non) Integrated PV | NEN, Dutch Standard



Peter van de Leur le@dgm.nl

23 June 2012

Scope

Target:

- Roofs
- Facades
- Traditional and Integrated

Safety Aspects

- Rapid fire growth over surface
- Propagation between fire compartments



Actual situation NL

Large fires reported

- Regulation requirements insufficient
- Fire department guidelines
- Investigations into risks

Insurers

- Reluctant to insure PV
- Require A2 or B roof insulation
- Guidelines

Call for new regulation

- NEN comprehensive new standard for inclusion in regulations
- To cover all situations



PV | Roof / Facade

International standard: IEC 61730-2

Normative

- MST 23: national regulation, NL : SBI, class B/D (facade)
- MST 24: small flame test, ISO 11925-2

Informative

- Flame propagation =ANSI/UL 790
- Burning brands test

Base requirement: class C



Class	Flame propagation test			Burning Brands test	
	Heat release rate [kW]	Duration [min]	Maximum distance [m]	Mass [kg]	Duration [min]
A	378	10	1,8	2	5
B	378	10	2,4	0,5	4
C	325	4	3,9	0,009	3

PV | Roof

NL: roof construction: class Broof(t1), EN 1187
(burning brands test)

on-roof PV panels no requirement

In-roof BIPV: no tests available

International: IEC 61730-2

Conclusions:

- Standard roof panels OK in on-roof installation
- Standard roof panels unknown performance in BIPV



PV | Facade

NL: class B, EN 13501-1 (SBI)

Facade including PV panels

Panels class on incombustible substrate

- A : does not exist
- B : rare, only 3 seen in NL (classification reports, no test reports)
- C,D : glass - glass
- E, F: glass - plastic (class C | UL 790)

International: IEC 61730-2

Conclusions:

- standard roof panels non compliant on facade
- B class facade needs improved glass - glass

dGm^R

SPONSOR
KAMELEON SOLAR
PRODUCT DETAILS
- Totale dikte: 10 mm ± 1 mm - Totaal oppervlaktegewicht: 22500 g/m² - Geen brandvertragers - Dikte gekleurd glaspaneel (voorzijde): 4 mm - Kleur: Zoals getest (zie Figuur 2 van rapport 20351C) – glaspaneel werd hiervoor bedrukt met keramische inkt - Dikte gehard achterglas: 5 mm - Voor verdere details, zie Figuur 1 van rapport 20351C (gedetailleerde productsamenstelling)

FIELD OF APPLICATION
- Ondergrond: Euroklasse A2-s1,d0 of beter, behalve gipskartonplaat 9 mm en een minimale densiteit van 652,5 kg/m³ - Met een geventileerde luchtsponw van 40 mm of groter - Mechanisch bevestigd op het substraat - Zonder voegen - Blootgestelde vuurzijde: Glaspaneel met keramisch bedrukte inkt

CLASSIFICATION
B-s1,d0
STANDARDS
Test standard: EN ISO 11925-2:2010/AC:2011 & EN 13823:2010+A1:2011 Classification standard: EN 13501-1:2018

SIGNED	APPROVED
	

Klassifizierungsbericht Nr. (classification report no.) 20201122/01 vom (dated) 04.12.2020

4.1 Klassifizierung Classification

Das Produkt „SKALA color“ wird nach seinem Brandverhalten wie folgt klassifiziert:
The product „SKALA color“ in relation with the fire behaviour is classified:

B

Die zusätzliche Klassifizierung zur Rauchentwicklung ist:
The additional classification in relation with smoke production is:

s2

Die zusätzliche Klassifizierung zum brennenden Abtropfen/Abfällen ist:
The additional classification in relation with burning droplets/particles is:

d0

Brandverhalten fire behaviour	Rauchentwicklung smoke production	Brennendes Abtropfen burning droplets
B	s2	d0

Klassifizierung des Brandverhaltens: B – s2, d0
classification of fire behaviour: B – s2, d0



RAPPORTO DI PROVA - TEST REPORT

JOB No. 190988	Data/Date 15/01/2020	Vi. ref.: prov. PCEPBA00200088 ordine del 02/10/2019
Richiedente/Applicant	Heliartec Solutions Corporation, Ltd. 4F-7, No.8, Taiyuan 1 st Street, Zhubei City, HsinChu County 302, Taiwan	
Prodotto/Identificazione e descrizione/ Product identification and description	Colored Laminated Safety Photovoltaic Glass AEP-52A5A Front Glass-5mm, Front PVB-2*0.38mm, Back Black PVB-m*0.5mm (A-m=1), Back Glass-5mm, Stacking-A:Ultra Clear/Soda-lime Glass	
Prova/Tests	n.1 prova di reazione al fuoco	
Reference standard	UNI EN 13823:2014 Prodotti da costruzione esclusi i pavimenti esposti ad un attacco termico prodotto da un singolo oggetto in combustione (SBI) Building products excluding flooring exposed to the thermal attack by a single burning item.	
Period	07-15/01/2020	
Reported on the following pages	riportati nelle pagine seguenti	
Pro/Laboratory	Per. Maurizio Biagini	

Il prova, riproducibile nella sua sola stesura integrale, si riferisce al solo prodotto esaminato.
The report refers only to the tested item and it can be reproduced only in its full version.

Nota 18/11/2019 – Campionamento eseguito dal Richiedente
Note: Sampling performed by the Applicant.

Come ottenuta in accordo alla norma / Classification obtained in accordance to the standard UNI EN 13501-1:2019		
Fuoco	Produzione fumi Smoke production	Parti infiammanti Flaminga droplets
	s1	d0

Flat roof | on-roof

Flying brands

- Roof outside PV field : Broof(t1) (**modified**)
- Roof below panels: Broof(t1) not appropriate, increased thermal attack on roof covering due to enclosure

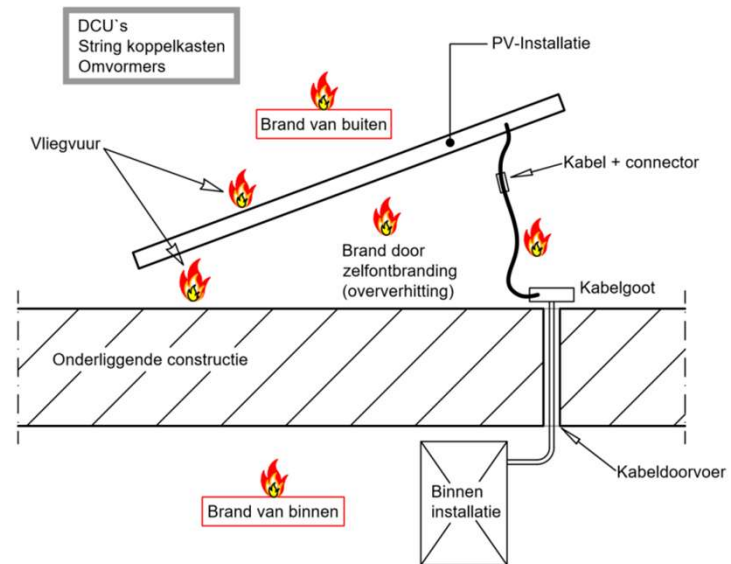
New test to be developed:

- 15 kW ring burner CENELEC TR/ 50670
- Between roof covering and PV panel
- Scale ca. [6] panels.

Criteria:

- Spread horizontal over roof
- Spread to building below roof (penetration of roof construction)

Figuur 8 – Montagewijze 2, plat dak



Flat roof | on-roof

Fire from outside

- Heat radiation + flying brands from :
 - Fire in adjacent building
 - Windows in compartment rising facade
 - Adjacent fire compartment, non fire resistant roof
 - Own fire compartment, skylights in fire resistant roof

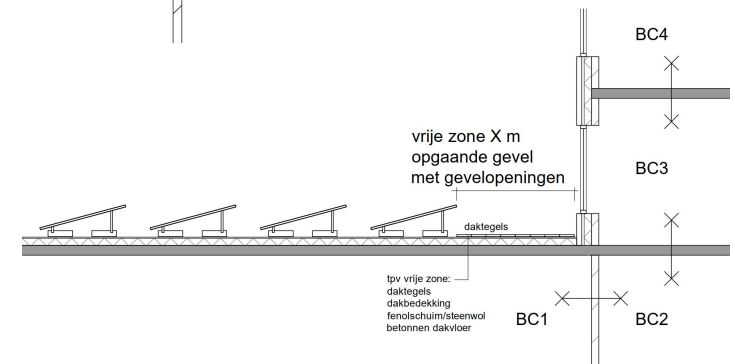
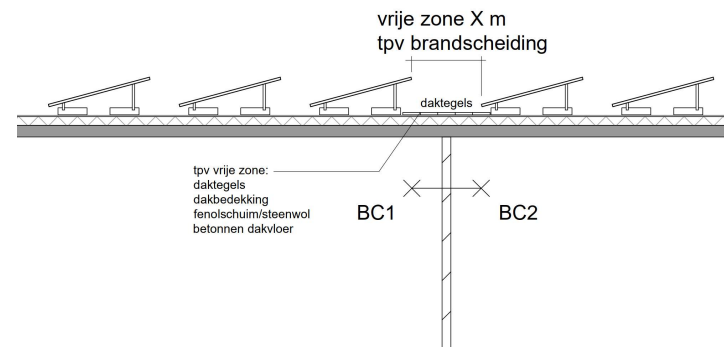
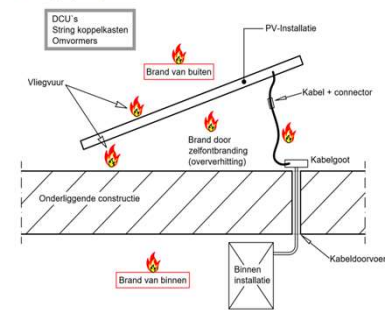
→ Thermal radiation flux on roof and PV

Option 1 : no PV in area $Q > [2] \text{ kW/m}^2$

Option 2 : PV in area $Q > [2] \text{ kW/m}^2$

- TEST A, higher thermal load (flame + radiation)

Figuur 8 – Montagewijze 2, plat dak



Flat roof | on-roof

Auto ignition / electrical arc

- HRR arc around 50% of power generated in string

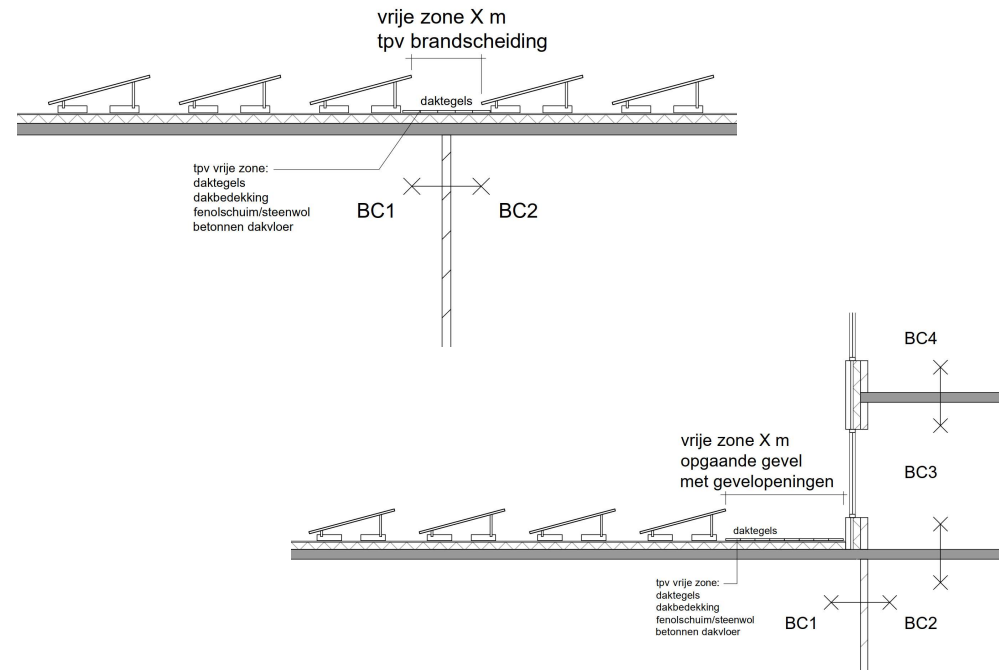
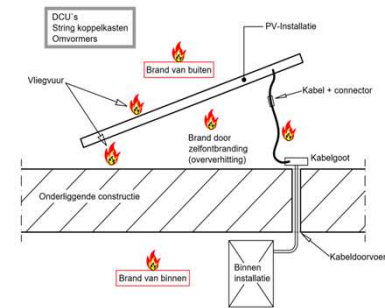
Option 1 : no unprotected components or connections in roof construction

- No action required

Option 2 : unprotected components or connections present in roof construction

- TEST A, electrical source 2 kW in roof construction (power, duration to be determined)

Figuur 8 – Montagewijze 2, plat dak



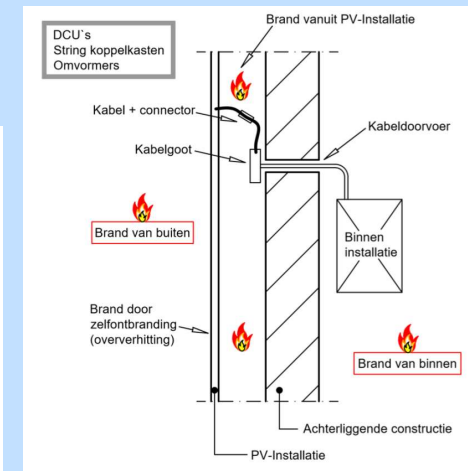
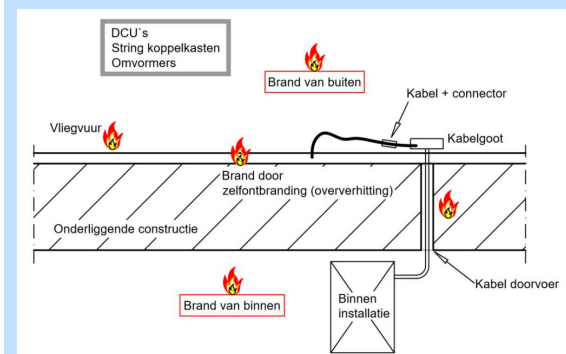
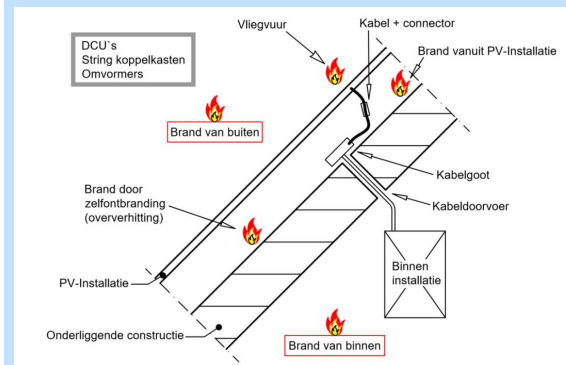
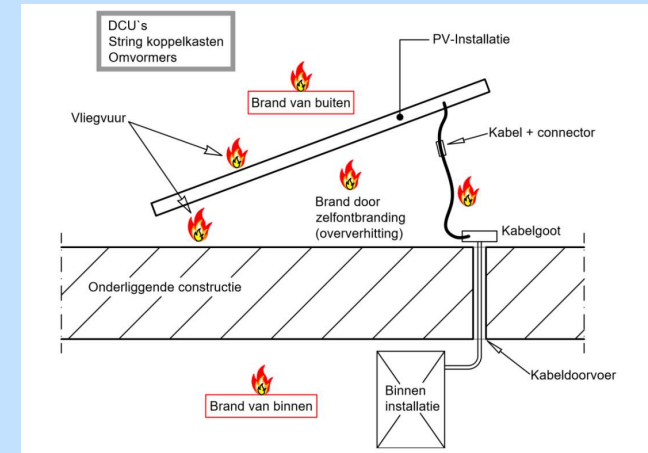
NEN | development new standard

On-roof, flat roof

- External exposure : CENELEC TR/50670, panels and roof
- Fire in other building/compartment: class C/D where incident radiation flux exceeds 20 kW/m^2
- Fire between panel and roof: new mid scale test, 15 kW flame (or higher if electrical arc heat release is higher)

BIPV Facade or inclined roof

- External exposure roof: CENELEC TR/50670 roof only
- External exposure facade: classe B, increased risk situations BS 8414
- Internal exposure : new mid scale test to be developed
15 kW flame in ventilated cavity
2 kW electrical source, no cavity



Conclusions

Current situation unsafe

- On-roof installations, flat roofs: compliant but known to allow large roof fires
- BIPV roofs, all facades: non compliant with current NL regulations, allowing
 - large fires
 - fire propagation between compartments
- Strict enforcement major block to PV deployment

Need for:

- new, more stringent standards
- safe PV installations
- safe solutions on buildings

NL not prepared to wait for CEN results

