



Fire behaviour of Flat Roofs with PV Panels

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On behalf of PU Europe

DISCLAIMER: While all the information and recommendations in this publication are to the best of our knowledge, information and belief accurate at the date of publication, nothing herein is to be construed as a warranty, express or otherwise.

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Objective

Research by PU-Europe (with support from NVPU and IVPU)

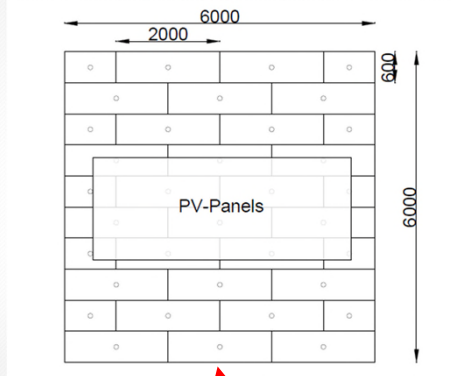
- conduct tests to understand the relative fire performance of a typical flat roof assembly insulated with two different FM-approved insulation boards, in the event of a fire starting in a PV array
- compare fire spread and fire penetration
- research whether a requirement for non-combustible insulation below PV systems makes any difference
- Assist in the development of a test method for this fire scenario
- ad-hoc test method, based on the work of Kristensen & Jomaas(1) , but used a different ignition source and 4 PV panels rather than 6

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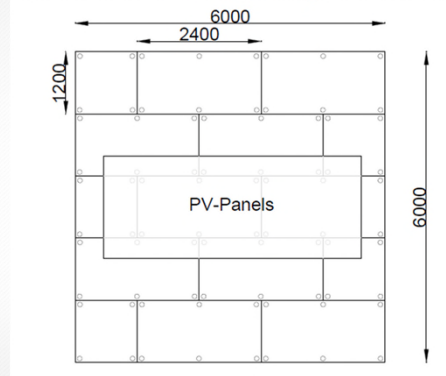


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Research flat roofs with Solar panels



Stonewool, PVC and PV



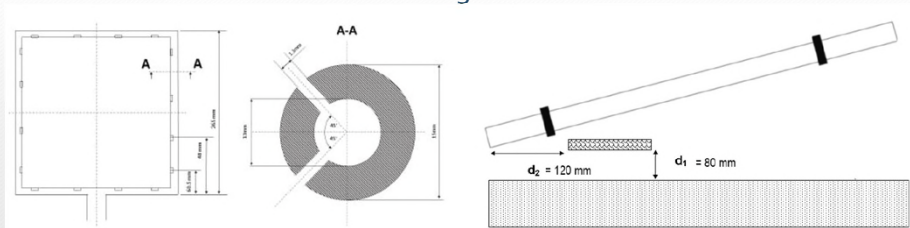
PIR, PVC and PV

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Test Procedure – Ignition and End Point

- 15 kW gas burner (acc. to CLC/TR 50670: 2016)
- Burner positioned below one PV panel, in the centre of its width
- 10 minutes exposure
- Allowed to burn until self-extinguishment



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Comparative fire tests of insulated flat roofs with photovoltaic installations.

Performed in September 2021 at Troned (NL)
under the supervision of Kiwa BDA.

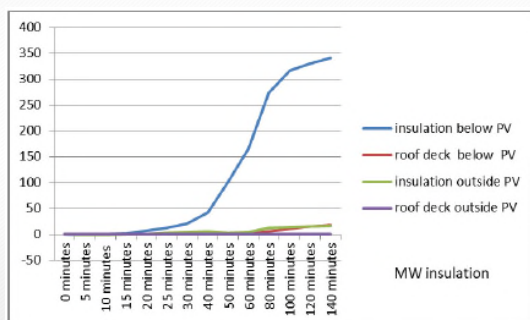
<https://www.youtube.com/watch?v=PC2MG0v78>

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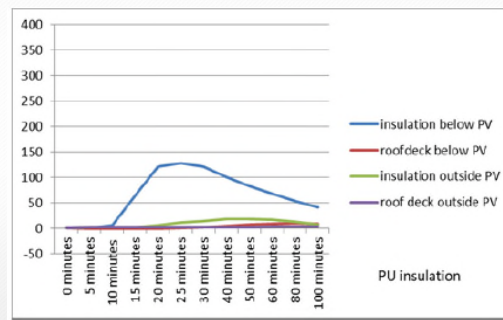


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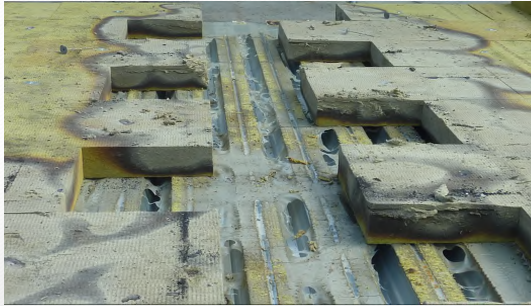
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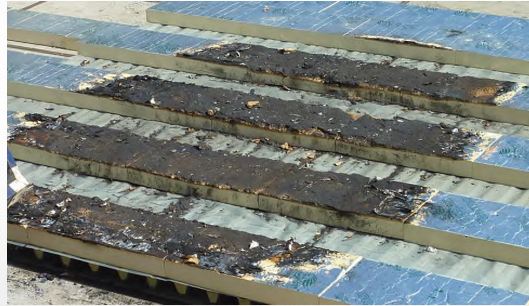


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Stonewool, PVC and PV



PIR, PVC and PV

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Considerations

- The results of these test are valid only for the scenario tested and the specific materials/build-ups tested
- In particular:
 - ✓ the back to back (East/West) configuration of the PV panels - testing of a roof with 2 rows of panels oriented in the same direction (South/South) would be quite possible, but it is expected that this would result in a less onerous fire load and thus the results shown in this paper may not be representative
 - ✓ different PV panels and mounting systems
 - ✓ different roof constructions and individual products

PU Europe - [Factsheet on the test](#)

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Reaction to Fire – Photovoltaic panels

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Reaction to Fire - PV panels

- No building product so no Reaction to Fire regulated via CE
- Reaction to Fire not always indicated
- Reaction to Fire often based on UL standard
- RIVM did research¹ on:
 - ✓ Deposition in the surroundings of a fire involving PV
 - ✓ Reaction to fire of PV panels (burner as per CENELEC TR50670)

(1) [RIVM-rapport 2022-0103 N.W. van Veen et al.](#)

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Reaction to Fire - PV panels

Exp.	Type PV panel	Fire rating (standard)	first droplets	continues droplets	burning droplets > 5 sec.	first glass cracking	Continues burning after gasburner turned off
1	Thin-Film	Class C (IEC)	01:06	n.a.	n.a.	01:20	< 2 min
2	PC glass-foil	Class C (IEC)	01:25	01:25	01:25	n.r.	< 3 min
3	MC glass-glass	Fireproof	04:00	04:00	04:30	01:12	< 3 min
4	MC glass-glass	n.a.	01:00	02:00	02:00	02:00	< 3 min
5	MC glass-foil	Type 1 or 2 (UL)	00:41	01:30	00:41	n.r.	> 3 min
6	MC glass-foil	Type 1 (UL)	00:07	00:07	00:07	n.r.	9 min
7	PC glass-foil	n.a.	00:16	00:16	00:16	01:04	< 3 min
8	PC glass-foil	n.a.	02:05	02:35	02:35	n.r.	< 3 min
9	Thin-Film	Class C (IEC)	00:22	n.a.	n.a.	01:22	< 2 min

Tabel extract from RIVM-rapport 2022-0103

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Tabel extract from RIVM-rapport 2022-0103

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Conclusions

- The fire impact on a roof can be much higher with PV panels than without
- A PIR insulated flat roof with a combustible roofcover can achieve fire safety requirements, also when PV panels are present
 - ✓ Flame spread
 - ✓ Burn through
 - ✓ Roof self extinguished
- The system performance is determinant!
Simply prescribing non-combustible insulation whenever there is a BAPV is not the answer

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Questions

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