PV Protect

Fire protection for roofs with photovoltaic systems

David Bell

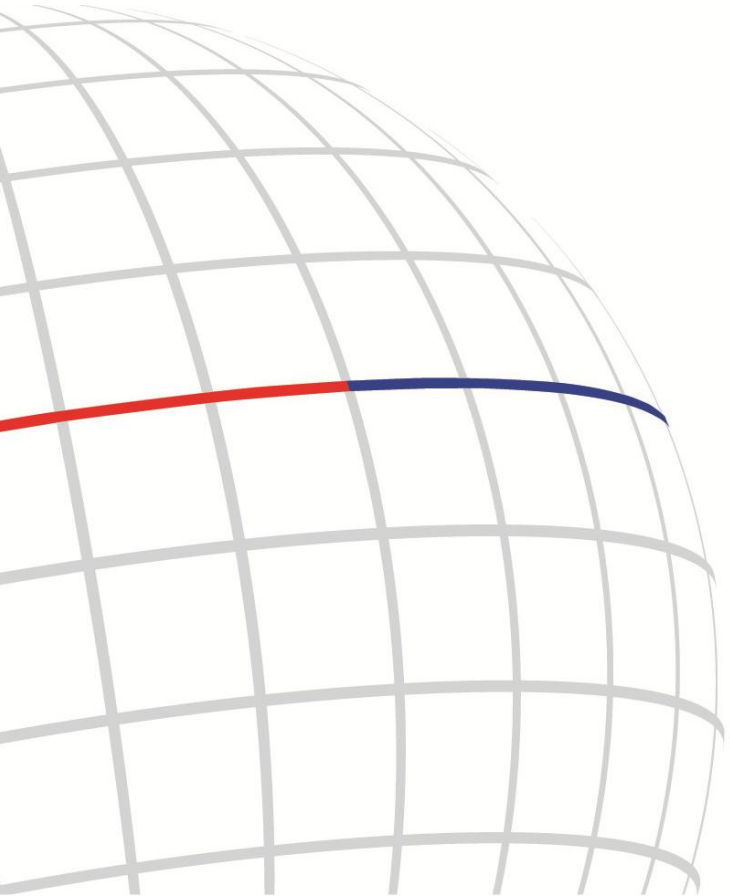
Global product Manager Water Mist systems

Minimax Viking Product group

Fire Protection.

Agenda

1) Challenges of the application
2) Design and Function
3) Conclusion



Fire Protection.

Roof top Photo Voltaic Systems – A new Risk?

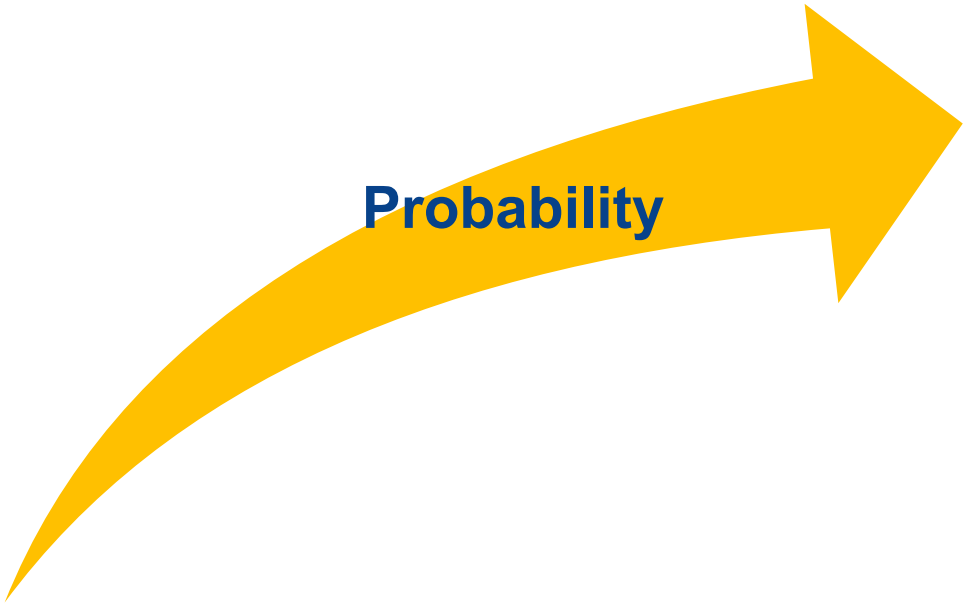
- Leveraging the use of Industrial roof top space to generate additional power is increasing globally year on year.

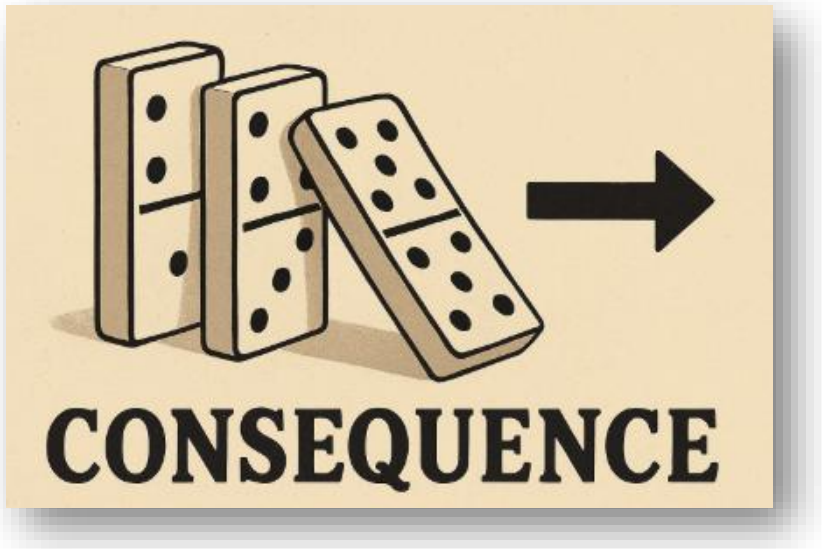
- A UK Government Quote '**The Untapped potential of commercial buildings could revolutionise UK solar power'**

Increase the Likelihood of Ignition

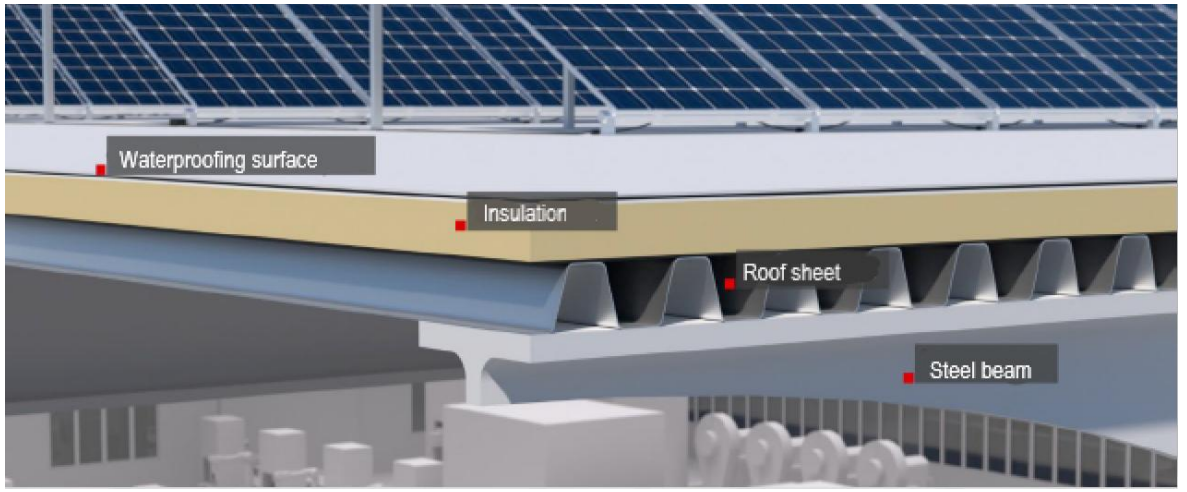
Faster Fire spread

- Roof top Pv Systems increase both :-





WHAT - Challenges of the application



- Electrical systems as potential ignition sources

  Atmospheric influences lead to rapid ageing and damage to cable and plug connections.

  Most common causes of fires: installation errors, product Defects or design faults.

Increased fire risk

- Roofs with flammable insulation

  Incipient fires spread to insulation

  Accelerated spread via the roof structure

  Concealed fires emerge unexpectedly

Rapid and undetected fire spread

- Electrical systems as potential ignition sources

The Clean energy Associates found that after an audit of 600 rooftop PV installations , 97% of the systems had safety concerns.
These results are also in line with findings from other leading insurers.

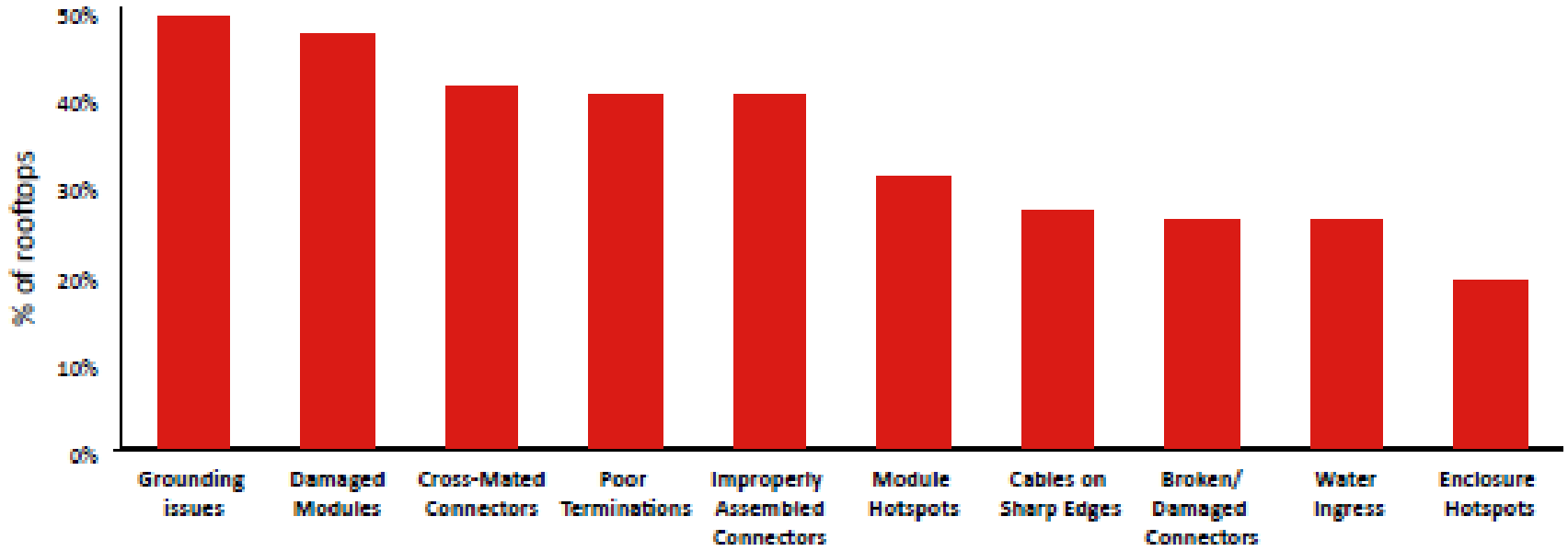


Figure 1: Overview of the failures reported by the Clean Energy Associates (CEA) (https://www.cea3.com/cea-blog/top-10-pv-rooftop-safety-risks) in 2023.

What else can go wrong

- Birds destroying PV panels

https://www.mysquirrelguard.com/

- Vermin chewing through the cables.

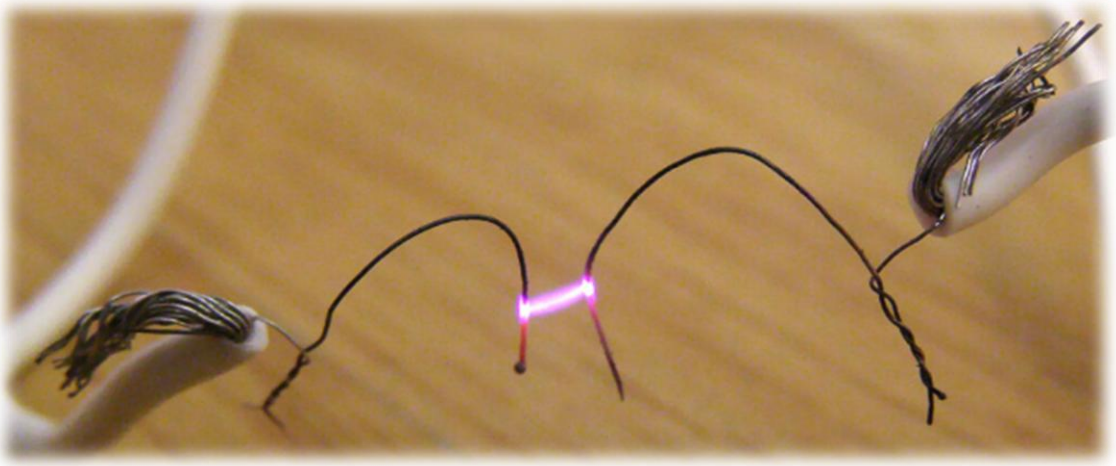
Figure 9 improper cable support with exposure to physical damage

http://www.brooksolar.com/files/Field_Inspection_Guide-8-19-accepted.pdf

Figure 10 poor conductor handling and bending radius too tight

- Poor Installation

WHAT - Arc Forming



Khimich Alex, Wikimedia Commons

- Potential for Arc Forming is a real and present danger in PV Installations
- Conditions required,
- DC Current
- Cable Damage/Line break
- Potential for poor installation

WHY - Challenges of the application

- Undetected fire spread

  Few flames for a long time.
  Smoke dispersed by wind/air movement
  Limited visibility of the roof from ground level

Fire detected too late

- Difficult conditions for the fire and rescue services

  Accessing the roof can take time

  Seat of the fire cannot be localised

  Fire spread impossible to determine

Firefighting starts too late

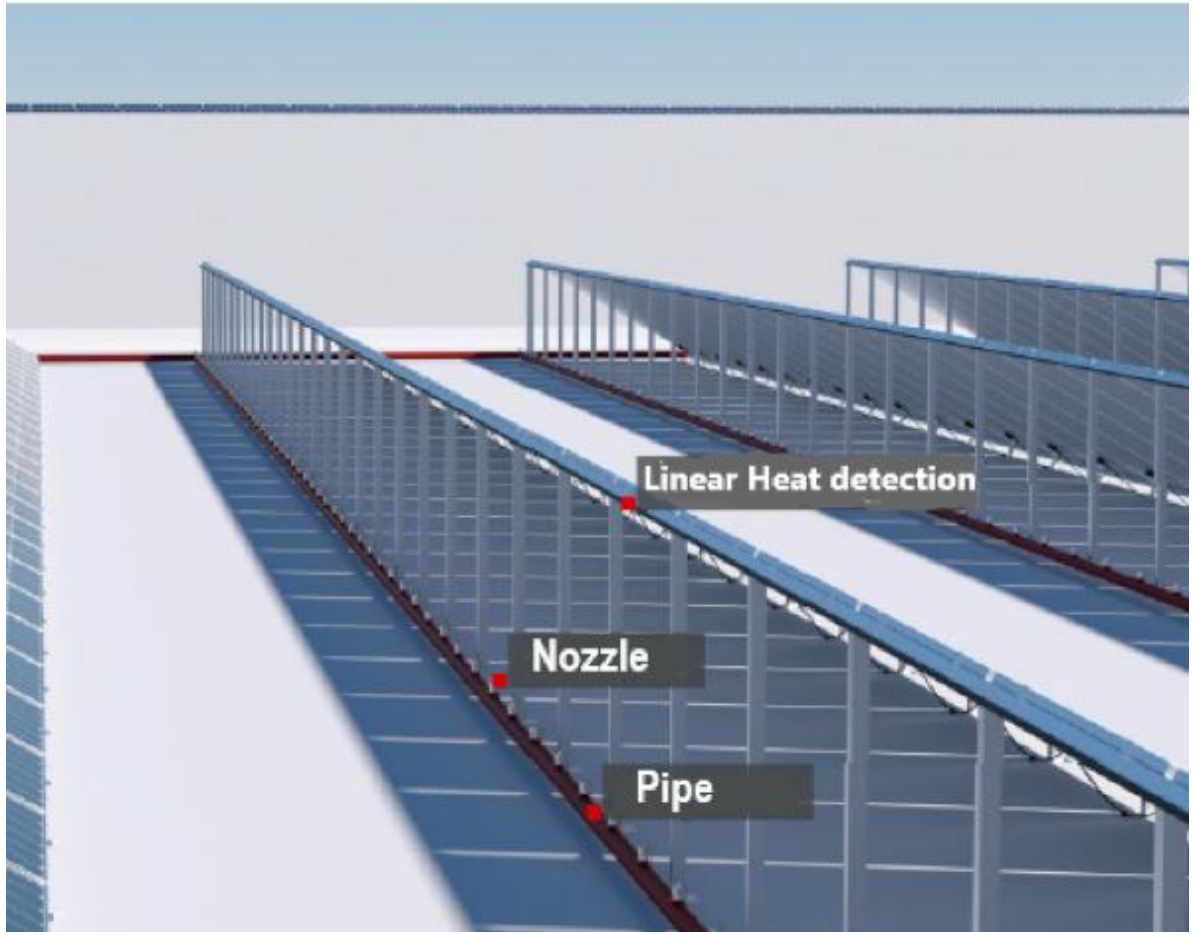
What can go wrong?

- Small Fire spreading into a catastrophic Event

  Generally PV Fires start very small , often well under 1m2

  Can Spread very quickly if un - checked.

THE Solution



The system

- Latest technology Linear heat detection with specific Criteria and design parameters.
- Specially designed and patented nozzles to protect the roof.

Combined with the more traditional -

- Pipes
- Fire detection control panel
- Deluge control valve
- Water supply

Operating mode

- linear cable detect rise in temperature.
- Temperature rise signalled to the fire detection and extinguishing panel.
- Panel triggers alarms and activates the firefighting system.
- Extinguishing water is discharged through the PV nozzles to control the fire on the roof – NOT the Pv Panels.
- All using low pressure Low flow technology with small K factors.

Fully fire tested

1) Ignition

2) Simulated
Air flow Via Fan

3) Control

4) Suppression

Fully fire tested

VdS system approval .

And

VdS component Approval for the nozzles gives AHJ's and specifiers confidence the system has been independently tested in a 3rd party laboratory.

Anerkennung
Approval

VdS

von Bauteilen und Systemen
of Components and Systems

Inhaber der Anerkennung / Holder of the Approval

Minimax GmbH
Industriestraße 10 - 12
DE-23840 Bad Oldesloe

Anerkennungs-Nr. / Approval No.	Anzahl der Seiten / No. of pages	gültig vom (TT.MM.JJJJ) / valid from (dd.mm.yyyy)	gültig bis (TT.MM.JJJJ) / valid until (dd.mm.yyyy)
G 423018	4	21.08.2024	20.08.2028

Gegenstand der Anerkennung / Subject of the Approval

Niederdruck Wassernebel-Düse/
Low pressure water mist nozzle
"PV K...-Ms"

Verwendung / Use

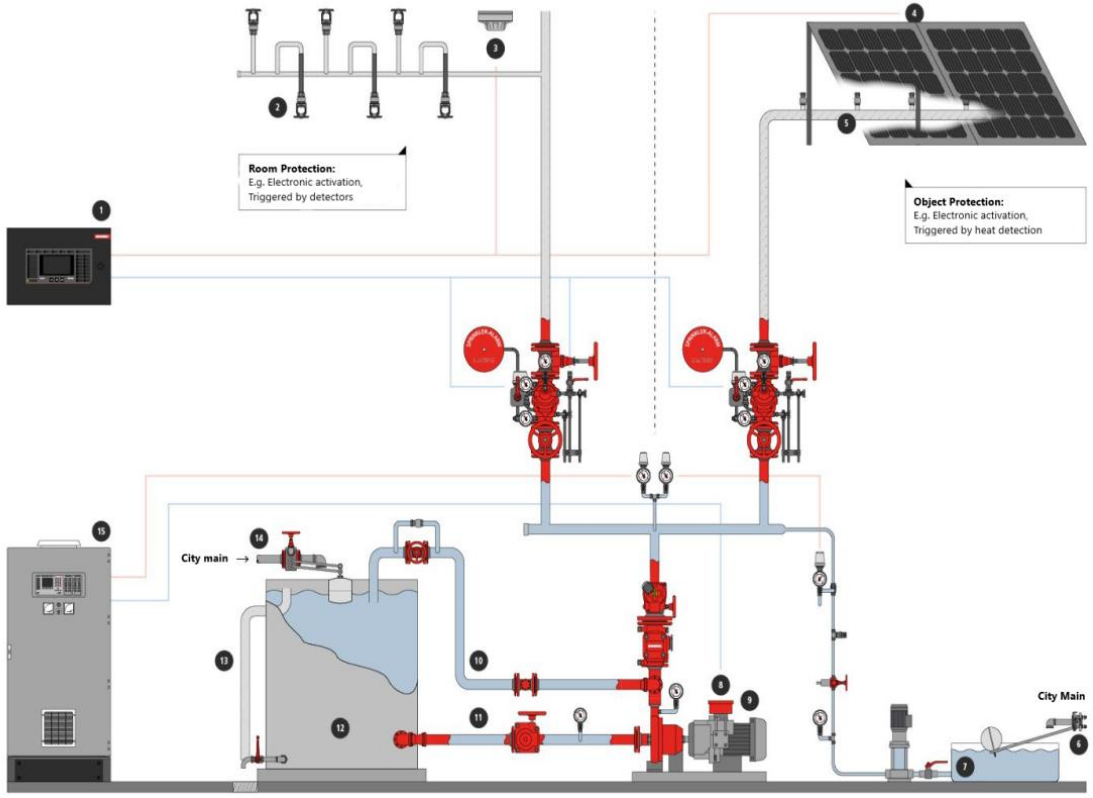
in ortsfesten Systemen gemäß Anlage 3 /
in stationary systems according to annex 3

Anerkennungsgrundlagen / Basis of the Approval

VdS 2344:2014-07
VdS 3100-46:2022-08

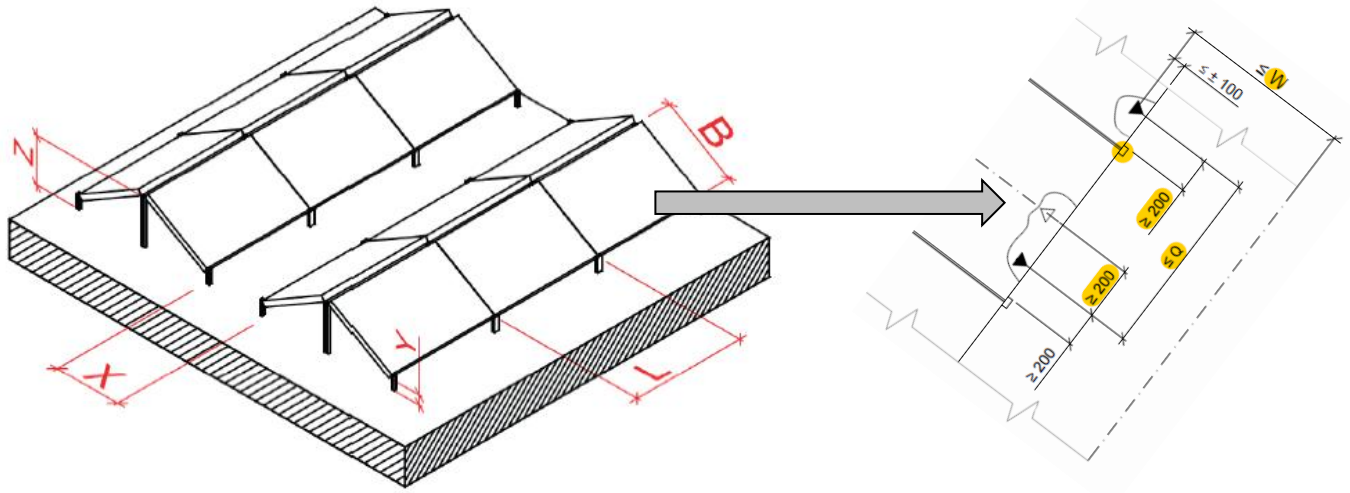
System Parameters

- Detection by VdS or FM/UL/EN 54 listed approved Linear heat detection detector cable. With fast response time.
- Flat Roofs with PV systems
- Planning Criteria – System Manual (3rd Party approved)
- Water operation time 60 minutes.



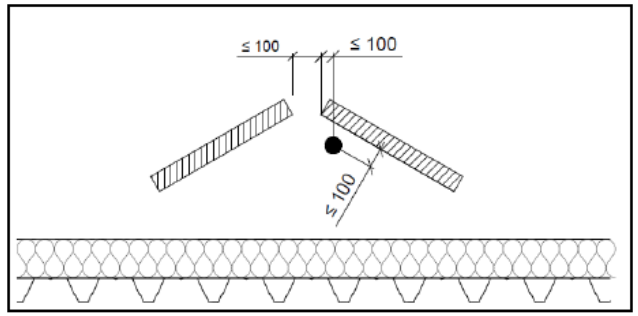
1. Fire detection and extinguishing control panel
2. Room protection nozzle
3. Electric fire detector
4. Heat detector
5. PV nozzle
6. Automatic feed
7. Storage tank
8. Pressure-maintaining pump
9. Sprinkler pump
10. Pump test pipe
11. Suction pipe
12. Surge tank
13. Overflow
14. Automatic feed
15. Pump control cabinet

Design Parameters Example – Apex or East West PV Layout



Typical Install would be to allow for 1 or 2 Nozzles For Each Pv Panel.
1 – Protection of the Roof Under the Pv Unit
2 – Protection of the Safety strip around and Potential roof load.

Maximum roof zone size = water supply capability Or LHD zone size.



PV modules		Distance between single rows	Clearance under PV module (eave)	Clearance under PV module (ridge)	Estimated water consumption per PV module
L	B	X	Y	Z	
≤ 1.8 m	≤ 1.1 m	up to 1.2 m*	≥ 150 mm	≤ 1,6 m	15 l/min
≤ 2 m	≤ 1.2 m				19 l/min
≤ 3 m	≤ 1.5 m				34 l/min
≤ 1.8 m	≤ 1.1 m	over 1.2 m			22 l/min
≤ 2 m	≤ 1.2 m				26 l/min
≤ 3 m	≤ 1.5 m				51 l/min

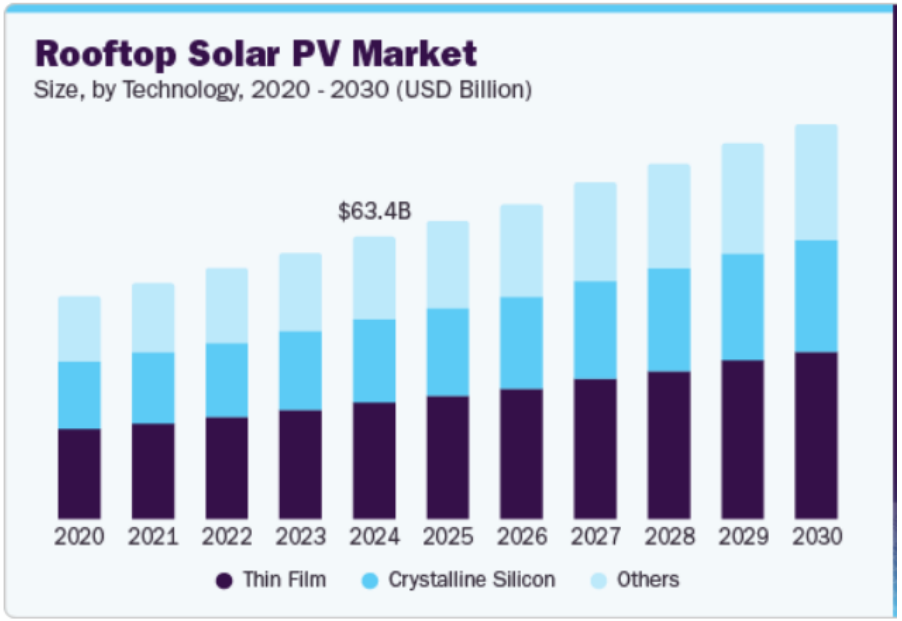
• Linear heat detector

Design Parameters – PV Protect – Typical system Components

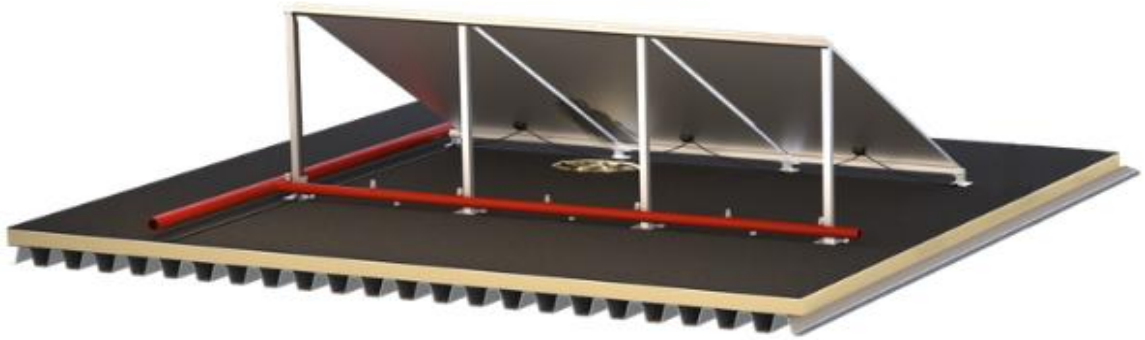
- System Concept. – All components tested to work together.
- Low operating pressure
- Pv Open Nozzles
- Strainer to ensure clear water supply due to small orifice nozzles..
- Deluge system or systems Linked to approved control panel.
- Corrosion resistant pipe.
- Suitable water supply.

Conclusion -

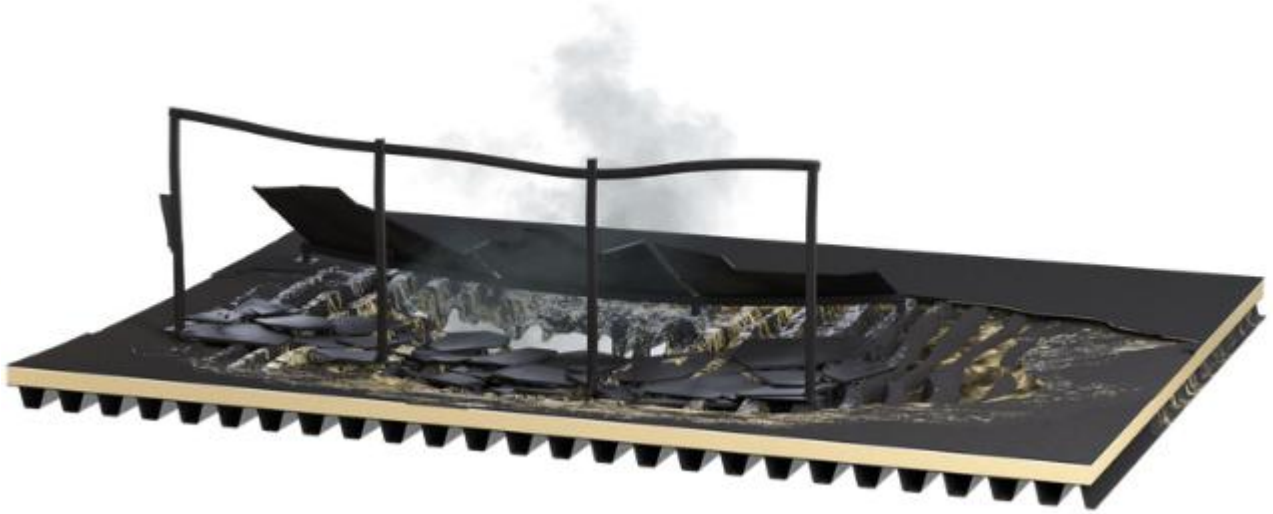
- Pv Panel Fire events can and will only increase.
- Roof top PV build expected to rise year on year up to 2030, and beyond? E.g. EU commission strategy for solar energy (EPBD).
- Roof top PV Panels will contribute large amounts of global power and therefore will become critical infrastructure.
- Reducing risk of large fires therefore is the only solution.



Conclusion



With PV Protect



Without Pv Protect

Thank You for listening.

David Bell

Global Product Manager – Water mist Systems

Minimax Viking Product Group GmbH.

+44 787 6883 894

belld@viking-emea.com