



PHOTOVOLTAIC SOLAR INSTALLATIONS

RISK MANAGEMENT GUIDANCE

Introduction

The use of photovoltaic (PV) panels has become increasingly common over the past decade, but the awareness of additional risks associated with these panels is less common. This brief guidance note has been produced to highlight some of these issues, and to provide guidance on how to prevent fires in these systems.

The Issues

There are two main issues associated with fire in PV systems. The first is to prevent a fire from originating, via well performed installation and maintenance practice. The second is to prevent the spread of fire, by allowing safe access to fire fighters, selecting the most suitable location, providing remote isolation and ensuring the correct use of materials.

Although the safety of PV panels is rarely questioned, simple malfunctions can create devastating electrical fires which are difficult for firefighters to control due to potentially dangerous exposed electronics and a lack of a detailed emergency plan associated with these PV panels.

Poor maintenance and electrical practice can increase the risk of a fire within a PV system and these issues can prevent full control of the fire by Fire and Rescue teams – leading to a large loss or total destruction of a facility.

When firefighters arrive at a burning building, they must disconnect the building electricity and other utilities. Each PV system possesses an inverter, which can store charge and send current back to the PV panels. The PV panels continue to produce power provided a source of light is present, which results in the wiring to the inverter remaining live with direct current, even after the main service panel has been shut off. This source of current can produce electric shocks to firefighters if the wiring is not isolated.

The fire can be tackled if the remains of the system is live, but this causes a delay while a dynamic risk assessment takes place. Once the fire is extinguished there is a concern that DC cables will remain live.

Fire Performance

In the event of an electrical fault, a fire can spread quickly throughout a PV system due to the highly combustible components used. This includes the frames, mounting systems, cables and boxes associated with the panels, many of which are constructed from plastic which will fuel any fire.

Solar PV systems are subject to electrical faults in the same way as household electronics. These faults can include arc faults, short circuits and reverse currents. Faulty connections or cable installation breakdowns can also cause problems. If these faults occur, then they cause hot spots that can ignite flammable material nearby. Fires can also be caused by incorrectly installed or defective DC/AC inverters.

Identification

Poor maintenance and poor installation practice are the main causes of fires within these systems. To reduce the risk of fires occurring, we suggest regular inspections and maintenance, including thermal imaging and removal of debris from the vicinity around the panels. The installation and maintenance should be performed by a competent person.

Next Steps

Ensure that the isolating procedure has been identified and is detailed on the premises fire risk assessment and site plans. Appropriate signage must be installed, so that Fire and Rescue teams can quickly and easily locate the supply in the event of a fire. Organise regular maintenance and inspections of the PV panels in accordance with the applicable British Standards, including those for electrical installations. Ensure that a detailed Risk Assessment and Safe System of Work has been completed for contractors carrying out any cleaning, repairs and maintenance to the system.

The inverter must be able to be safety isolated, with the means to be able to do so in an easily accessible location.



Risk Management Advice

New Installations

Protector should be made aware of any proposed new installation and a specification provided for review prior to tender. New installations should be performed by an experienced installer, accredited by an appropriate authority. A competent and certified installer will ensure the equipment is of good standard and provides details of required maintenance checks to undertake in the future. Before installing, a detailed risk assessment and safe system of work should be completed.

Fire Safety must also be considered during the installation works, including avoiding Hot Work and complying with best practice such as the HSE guidance on Fire Safety on Construction Sites and the Joint code of Practice Fire Prevention on Construction sites (via Fire Protection Association). We also recommend that a Clerk of Works be used as a means of ensuring on-site compliance during installation.

General Installation

- Do not install PV systems on industrial and commercial buildings with combustible roofs or over roof-lights.
- Avoid installing on buildings of high risk (such as heritage buildings), or those presenting a high risk occupancy or where there is significant financial dependency on the building.
- Do not install where accumulations of dirt, dust and deposits can occur.
- Do not install in an area with combustible material in the vicinity.
- All electrical control panels should be located within minimum 60 minute fire rated enclosures and suitably fire stopped around all cable penetrations. The enclosure should be provided with smoke detection linked to the main fire alarm system, which is in turn remotely monitored at an Alarm Receiving Centre.
- Ensure that a structural engineer has confirmed the roof can withstand the additional mechanical loading due to the weight of PV panels, or additional wind-loading caused by the panels.
- Consider the risks from storm damage, and falling snow and ice from the panels and if necessary install a protective mesh barrier at the eaves.
- It is preferable for PV panels to be mounted parallel to the angle of the roof.
- Consider the need for fire suppression of the PV panels and associated electrical components.

PV Panels

- Only use PV panels that comply with UK/international standards for electrical performance and safety.
- Mounting systems and frames should be non-combustible
- The roof should have areas surrounding the panels free to allow safe access for firefighting and maintenance. We recommend a minimum of 1.2m wide pathways and the separation distance from fire walls and heat vents as per fire protection standards.

Cables

- PV cables should be moisture, flame and UV resistant to reduce the likelihood of arcing.
- PV cables should be fixed and enclosed in metal conduit, without running over sharp edges to avoid mechanical damage.
- Cable routing should not compromise fire compartmentation of the building
- The main DC cables from PV module to inverter should ideally be routed along the exterior of the building, or if not, routed in a fire-resistant enclosure through the interior.

Inverters

- The inverter should be easily accessible and protected from severe weather conditions, positioned in a separate fire rated non-combustible enclosure and provided with smoke detection linked to the main fire alarm system.
- The inverter should be placed on non-combustible walls.

Batteries

- If batteries are present, they should be located in a cut-off and fire separated room/enclosure, with smoke detection linked to the main fire alarm system.

Disconnect Requirements

- A DC isolator switch should be installed (fire-fighters switch), to ensure safe disconnection of the inverter in the event of a fire.
- DC disconnection switches should be provided with remote actuators, positioned close to the PV panels to minimise live cable lengths.
- DC isolators must be capable of breaking both positive and negative connections under full load.

Emergency Response

- The local fire and rescue team should be informed and familiarised with the PV installation.
- PV systems should be clearly labelled, with external signage showing the location of the isolation switches
- Emergency plans should be in place, including the disconnection method. We recommend that this information along with site plans and installation drawings are provided within Emergency Plans Boxes or Grab Bags.

Maintenance and Inspection

- Thermal imaging inspections should be conducted at commissioning and at least annually to look for hotspots.
- Provide regular maintenance, including cleaning to ensure that debris does not build up.
- The Fire-fighters switch should also be tested/exercised periodically.

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