SAFE ELECTRIFICATION CHECK LIST
PHOTOVOLTAIC PANELS

FEEDS
Forum for European Electrical Domestic Safety

INTRODUCTION

The safe electrification check lists initiated by the Forum for European Electrical Safety (FEEDS, www.feedsnet.org) aim to provide the installer and the user with essential information regarding the electrical safety of the installation.

DESCRIPTION

Solar energy works by converting light energy (photons) from the sun into electricity, mainly through photovoltaic (PV) panels. When the sun shines onto a solar panel, energy from the sunlight is absorbed by the PV cells in the panel. This energy creates electrical charges that move in response to an internal electrical field in the cell, causing electricity to flow. The electricity collected by the PV panels is called direct current (DC) electricity. The DC electricity then moves to an inverter where it is converted to alternating current (AC) electricity. It is this AC electricity that is useable and can power homes, car or be sent to the electricity grid.

BEFORE INSTALLATION

CLIENT

- Make sure to ask for a qualified and, where relevant, certified installer.
- Contact with the energy utility manager/DSO: depending on the country and the size of the installation the energy utility can accept or not the project.
- Check if and which subsidies are available, and if electrical upgrades are covered.
- Consider the power increase: if change of meter is required, switch to a smart meter.
- Discuss with the installer the potential integration of a battery.
  - Check if specific grants are available for integrated systems (PV with battery and/or more systems).
- Check the existence of an electrical inspection report. The report can assess the safety, the readiness to accept new electrical load. If no report is available, it is recommended to ask one if the electrical installation has more than 5 year.

INSTALLER

- Verify the main electrical panel size and the space availability for new protections.
  - Consider a potential expansion of the PV system and integration with other (future) installations (Electrical vehicle charging point, heat pumps, Building Automation and Control Systems - BACS, etc.).
  - For 3-phase system, check the voltage (can be 230 V or 400 V in countries like Belgium and Norway).
- Consider the ideal and fire-safe placement of inverter and relevant equipment.
- Control earthing system.
- Plan cables paths and sizing (See annex).
- Consider data connectivity of the inverter.

DURING INSTALLATION

INSTALLER

- Follow the recommendations given by the manufacturer, they can differ from one to another.
- Use the cables size and specification in accordance with relevant standards (See annex for recommendations).
- Follow the relevant standards and legal requirements for installation available at national level.
- Place the inverter and equipment in a fire-safe zone.
- Make sure cables are correctly attached, protected, not hanging loose, and that they are not pinched or under compression (for instance between roof tiles).

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AFTER INSTALLATION

CLIENT

- Declare the installation to the local fire brigade, the insurance company.
- Keep carefully the documentation provided, related to the equipment and its installation and respect the maintenance plan.

INSTALLER

- Test and control of the new installation, this final check can be performed by a third party and can be mandatory depending on the country.
- Specific attention shall be given to cables, connections, earthing, protection devices.
- Complete the existing inspection report.
- Communicate a maintenance plan with key information visible on the equipment.

ANNEX – CABLE SIZING

To avoid losses and risks of overheating, it is crucial to choose the right cables diameter for the electrical installation. The cables cross section is determined according to the intensity of the current (A) and the distance to be covered. Here, it is necessary to distinguish the DC and AC parts of the installation.

DC: Minimum cable section which must be respected between the solar PV generator and the batteries or the inverter considering 5% voltage drops.

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Minimum cable section for 24V installations

12V and 48V tables are available here:

Peak power (Wp)	100	160	320	450	640	800	960	1120	1250	1440	1600	1920
Intensity (A)	3	5	10	15	20	25	30	35	40	45	50	60
Length (m)	Cable section (mm²)											
4	4	4	4	4	4	4	4	4	6	6	6	10
5	4	4	4	4	4	4	6	6	6	10	10	10
6	4	4	4	4	4	6	6	6	10	10	10	16
7	4	4	4	4	4	6	6	10	10	10	10	16
8	4	4	4	4	6	6	10	10	10	16	16	16
9	4	4	4	4	6	10	10	10	16	16	16	16
10	4	4	4	6	6	10	10	10	16	16	16	25
15	4	4	6	6	10	16	16	16	25	25	25	35
20	4	4	6	10	10	16	25	25	25	35	35	35

AC: For cables from PV (or batteries) inverter to the meter, it is also possible to consider cable optimisation that allows a better energy efficiency along the installation life time according to IEC 60 287-3-2 standard.

Electrical power (kW)	Power supply type	Cable lengths (m)	Minimal cross section (mm²)	Optimised cross section (mm²)
2	1-phase	10	2.5	4
2	1-phase	25	2.5	4
5	1-phase	50	4	10
5	1-phase	10	6	10
5	3-phase	25	2.5	4
5	3-phase	50	2.5	4
10	3-phase	10	2.5	6
10	3-phase	25	2.5	6
10	3-phase	50	2.5	6