

GUIDANCE NOTE

Solar PV Operation, Monitoring and Maintenance Specification

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Department for
Energy Security
& Net Zero



North West
Net Zero Hub

Solar PV Operation, Monitoring and Maintenance Specification

Guidance note for purchasers and operators of non-domestic solar PV systems

1. Purpose and Overview

This specification sets out a proportionate operation, monitoring and maintenance requirement for solar photovoltaic (PV) systems installed on non-domestic buildings and estates, including schools, leisure centres, offices, depots, libraries and other assets.

Solar PV systems are generally low-maintenance assets, but they require periodic inspection, performance monitoring and fault response to maintain safe operation, protect financial value, support warranty claims and provide an auditable record of asset management. The aim is a proportionate maintenance regime matched to system size and value. Domestic solar installations are usually small and largely maintenance free, while larger assets are more likely to justify a maintenance programme. The priority is to ensure that systems are safe, available, performing as expected and subject to a clear fault-response process.

For well-installed PV systems, the main value of maintenance is not routine intervention. It is knowing whether systems are working, detecting faults quickly, maintaining electrical safety, protecting warranties, evidencing good asset stewardship and avoiding generation losses.

The purchaser or operator should avoid relying solely on annual site visits to identify faults. The highest-value element of the maintenance regime is prompt identification of inverter outages, string faults, monitoring failures and other issues that materially reduce generation.

The purchaser or operator should therefore prioritise monitoring, inspection and fault response over a heavy planned maintenance regime. Cleaning should be treated carefully. It may be justified on some sites, particularly those with heavy bird fouling, shallow panel pitch, nearby trees, industrial dust or coastal deposits. However, blanket annual cleaning across a portfolio is unlikely to be best value unless supported by evidence of material soiling losses.

The most useful contract output is a simple portfolio performance report showing which systems are working well, which are underperforming, why, and what action is required. This allows the purchaser or operator to manage PV as a portfolio of energy assets rather than as a set of isolated rooftop installations.

The following document helps define when a solar PV maintenance programme is required and what should be expected of a maintenance contractor.

2. Scope of services

Contracted maintenance services should provide an operation, monitoring and maintenance service for grid-connected solar PV systems across the purchaser's or operator's non-domestic estate. The service should include:

- performance monitoring;
- annual inspection and reporting;
- fault diagnosis and reactive maintenance;
- periodic electrical testing;

Note: Adapt guidance for local procurement, legal and insurance requirements.

- cleaning, where justified;
- warranty support and asset records;
- health, safety and access management.

The contractor should maintain the systems in accordance with relevant legislation, standards and guidance, including as applicable:

- BS EN IEC 62446-1 – PV system documentation, commissioning and verification;
- BS EN IEC 62446-2 – maintenance of grid-connected PV systems;
- BS 7671 – Requirements for Electrical Installations;
- IET Code of Practice for Grid-connected Solar Photovoltaic Systems;
- Electricity at Work Regulations 1989;
- relevant HSE guidance, manufacturer requirements, insurance requirements and site-specific access procedures.
- MIS 3002 is an MCS installation standard for solar PV systems up to 50 kWp DC output. It is useful as a good-practice reference for documentation, commissioning, handover and maintenance information, but larger non-domestic systems may require additional requirements under the IET Code of Practice, BS EN IEC 62446 series, BS 7671, insurer requirements and site-specific commercial O&M practice.

3. Performance monitoring

Performance monitoring may be provided by the contractor or managed in-house where the purchaser/operator has suitable staff capacity, system access and clear escalation arrangements. As the number of owned solar assets increases, in-house monitoring may become more cost-effective, particularly where a single portfolio view can be used to identify outages, underperformance and communication failures across multiple sites. Monitoring shall include, as a minimum: generation output, inverter status, system availability, underperformance alerts, fault alerts, export information where available, and comparison against expected generation adjusted where possible for seasonality and system size.

Where a system does not currently have suitable monitoring, the contractor shall identify the gap and provide options for improving visibility. This may include inverter portal access, installation of a generation meter, integration with an energy management system, regular manual readings where remote monitoring is not currently viable.

The purchaser or operator should avoid relying solely on annual site visits to identify faults. The highest-value element of the maintenance regime is prompt identification of inverter outages, string faults, monitoring failures and other issues that materially reduce generation.

For systems with suitable monitoring capability, the maintenance arrangement should aim to identify full outages or abnormal operation within 48 hours. Where this is not currently possible, the contractor should identify the monitoring gap and recommend a proportionate upgrade or manual reporting process.

Where monitoring equipment requires connection to a purchaser, operator, school or third-party network, the contractor shall obtain approval from the relevant IT or information security lead before connection. Default passwords should be changed, credentials controlled and access arrangements documented.

Alerting, responsibilities and escalation

For systems with remote monitoring capability, automatic alerts should be configured for full system outages, inverter faults, monitoring communication failures and material underperformance. Alerts shall be issued to named contractor and purchaser/operator contacts, with nominated deputies where appropriate. Where monitoring is

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managed in-house, the purchaser/operator should identify the responsible role or team and define when issues are passed to the contractor for diagnosis, repair or site attendance. The alert routing, contact details and escalation route shall be documented at contract mobilisation and reviewed periodically.

The party responsible for monitoring shall review alerts within the agreed response period, classify the issue, confirm whether it is a system fault, monitoring fault, communications issue or site-side constraint, and identify the next action. Where contractor support is required, the contractor shall advise the purchaser/operator what action is needed. Where site access, IT support, shutdown approval or budget approval is required, the contractor shall identify this clearly and promptly so that responsibility for the next step is understood.

Event	Alert recipient	Initial action	Escalation
Full system outage	Contractor helpdesk and named purchaser/operator contact	Remote review within 1 working day	Site attendance if not resolved remotely
Inverter fault	Contractor monitoring lead or helpdesk	Diagnose via portal, error code or monitoring platform	Advise repair, warranty or replacement route
Material underperformance	Contractor monitoring lead	Compare output against expected generation and recent conditions	Investigate likely string, inverter, soiling, shading or meter issue
Monitoring communication failure	Contractor and named purchaser/operator contact	Confirm whether this is a system outage or monitoring-only issue	Escalate to site contact or IT support where access or network action is required
Safety-critical alert	Contractor duty contact and named purchaser/operator contact	Provide immediate advice and interim risk controls	Urgent attendance or isolation where required

4. Routine inspection

Each PV system should have a routine inspection interval agreed on a risk basis, taking account of system size, building use, roof access, monitoring quality, manufacturer requirements, installation regulations and insurer requirements. For many non-domestic systems, an annual visual and operational inspection may be appropriate, but a different interval may be equally justified by the risk assessment.

Visual inspection

- PV modules checked for obvious damage, delamination, staining, excessive soiling, cracked glass or signs of overheating.
- Mounting system checked for visible corrosion, loose fixings, movement, ballast displacement or roof interface issues.
- Cables checked for secure fixing, UV degradation, abrasion, water ingress, animal damage or poor routing.
- DC and AC isolators checked for condition, labelling, accessibility and signs of overheating.
- Inverters checked for operational status, ventilation, warning lights, error logs and physical condition.
- Generation display and reporting unit condition and function,
- Roof access routes, fall protection interfaces and exclusion zones reviewed where relevant.

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- DC connectors, glands and enclosures checked for secure fixing, signs of overheating, water ingress risk, poor routing, cable strain or loss of ingress protection.
- Roof condition and access constraints checked where visible, including roof penetrations, standing water, membrane damage, skylights, fragile roof elements, edge protection limitations and clear access routes between array blocks.
- Where present, inverter arc fault detection and other relevant safety functions checked to confirm they remain enabled.

Electrical and functional checks

- inverter operational status and fault logs;
- generation meter operation;
- visible earthing and bonding arrangements;
- isolator operation where safe and appropriate;
- comparison of system output against expected performance;
- confirmation that monitoring is functioning;
- confirmation that warning labels and shutdown instructions remain legible and in place.

5. Periodic electrical testing

In addition to annual visual inspections, more detailed electrical testing shall be undertaken on a risk-based cycle, typically every 3 to 5 years, unless manufacturer requirements, site risk, insurance requirements or observed defects indicate a different interval.

Testing may include insulation resistance testing, polarity checks, continuity of protective conductors, string open-circuit voltage checks, string current checks, verification of protective devices, inverter functional checks, review of AC connection condition and thermographic inspection, especially of isolators and MC4 connectors, after the relevant warranty period. Warranty periods may differ across system components, such as inverters and panels. Drone thermography can help identify panel hot spots and potential fire risks.

Electrical testing shall be undertaken by competent persons with appropriate PV and electrical qualifications. Testing should be coordinated where practical with wider fixed-wire inspection and testing programmes to reduce duplication and site disruption.

6. Cleaning

Routine cleaning should not be assumed to be necessary for every system. The contractor shall assess whether cleaning is justified based on observed soiling, system pitch, location, bird fouling, nearby trees, industrial or coastal exposure, performance data indicating material underperformance, and safe, cost-effective access.

Cleaning should be undertaken only where the expected generation benefit, warranty need or safety requirement justifies the cost and access risk. For many non-domestic rooftop systems, especially where panels are pitched and rainfall provides natural washing, routine cleaning may offer limited value. Cleaning should therefore be an optional or call-off activity, not a default requirement.

7. Fault response and reactive maintenance

The contractor shall provide a fault response service with clear response times. Suggested service levels are shown below.

Fault type	Example	Suggested response
Critical safety issue	Exposed conductor, fire damage, unsafe isolator, roof hazard	Immediate advice; attend within 24–48 hours
Major generation loss	Inverter failure or full system outage	Remote review within 1 working day; attend within 5 working days
Partial underperformance	String fault or monitoring anomaly	Review within 5 working days
Minor defect	Labelling or non-urgent physical defect	Address at next planned visit or agreed call-off

The contractor shall notify the purchaser/operator of any safety-critical issue immediately and provide interim risk controls where required. Where faults are identified, the contractor shall provide the fault description, likely cause, recommended corrective action, urgency, cost estimate where outside fixed scope, and estimated generation impact where practicable.

Where a site has a generation display or accessible inverter status display, site staff may be asked to check and report visible alarms, warning lights, damage, obvious changes or unexpected drops in output. Site staff should not access roofs or interfere with electrical equipment.

8. Reporting requirements

The contractor shall provide a short report following each inspection and a periodic performance summary, normally quarterly or annually. Reports shall include:

- site name and asset reference;
- system size;
- inverter details;
- inspection date;
- generation for the period;
- availability estimate;
- faults identified and corrective actions completed;
- outstanding actions and priority;
- photographs of relevant defects;
- recommendation on cleaning;
- warranty issues, inverter recommendations and safety concerns;
- inverter age, warranty status and replacement risk;
- monitoring status, including any outage-alert or communication failure;
- roof integrity or roof warranty concerns identified during inspection.
- comparison with expected generation where available.

Reports should identify visible concerns that may affect roof weather-tightness, roof covering condition, ballast movement, fixings, roof penetrations, standing water, membrane damage or roof warranty conditions. Where roof warranty implications are unclear, the purchaser/operator should confirm requirements with the roof warranty provider before authorising intrusive work.

Note: Adapt guidance for local procurement, legal and insurance requirements.

For portfolio management, the purchaser/operator should request a summary table showing the following fields:

Site	kWp	Annual generation	Expected generation	Availability	Faults	Actions	Priority
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9. Asset records and handover information

The purchaser/operator should have, and can use the maintenance contractor to help maintain or reconstruct, an asset record for each system. This should include:

- commissioning certificate;
- single-line diagram and system layout;
- module make, model and quantity, inverter make, model and serial number;
- commissioning forms, inspection records and PV array test reports;
- manufacturer user manuals and warranty details;
- recommended interval for the first periodic inspection;
- manufacturer- or installer-specific maintenance requirements;
- inverter installation date, warranty expiry, fault history and planned replacement window.
- generation meter details;
- MCS certificate where applicable;
- DNO documentation;
- Relevant roof structural information and roof access information;
- warranties and previous inspection reports;
- monitoring login details;
- shutdown procedure and fire service information where relevant.

Where documentation is missing, the contractor shall identify the gap and advise whether the absence materially affects safe operation, warranty claims or future maintenance.

10. Competence and health and safety

The contractor shall demonstrate competence in solar PV operation and maintenance, including suitably qualified electricians, experience of commercial rooftop PV, understanding of DC electrical risks, safe roof access procedures, working at height arrangements, asbestos awareness where relevant, RAMS for each site visit, and public building safeguarding and access protocols where applicable.

The contractor shall comply with all site-specific requirements, including school safeguarding, permit-to-work systems, roof access controls, asbestos registers and emergency procedures.

11. Commercial structure

The purchaser/operator should avoid a maintenance contract that incentivises unnecessary visits or blanket cleaning. A suitable structure would be:

Fixed annual fee

To include monitoring, annual inspection, annual report, helpdesk/basic fault triage, portfolio summary and minor remote diagnostics.

Note: Adapt guidance for local procurement, legal and insurance requirements.

Schedule of rates / call-off items

For replacement inverters, isolator replacement, cabling repairs, cleaning, access equipment, additional electrical testing, thermographic surveys, monitoring upgrades and generation meter installation.

Optional performance requirement

For larger portfolios, the purchaser/operator may request an annual availability measure or target, provided that exclusions are clearly defined for grid outages, access delays, force majeure, client-side communication failures and periods awaiting approval for chargeable repairs.

Maintenance/Lifecycle Reserve

Inverters typically have a shorter service life than PV modules and may require replacement during the operating life of the system, often within a broad 10–20 year planning window depending on product type, operating conditions, ventilation, warranty period and fault history. The purchaser/operator should maintain an inverter replacement schedule and either accrue for expected replacement through a lifecycle reserve or include provision within forward capital or revenue budgets. After 20+ years, panel degradation, roof condition and technology developments may also justify review of whether continued operation, partial replacement or full replacement offers better value.

Potential procurement wording

“The purchaser/operator is seeking a contractor to provide proportionate operation, monitoring and maintenance services for solar PV systems across its non-domestic estate. The service shall prioritise safe operation, system availability, performance monitoring, fault response, warranty protection and clear reporting.

The purchaser/operator does not require an unnecessarily intensive maintenance regime. The contractor shall adopt a risk-based approach, aligned where applicable with BS EN IEC 62446-2, BS 7671, the IET Code of Practice for Grid-connected Solar Photovoltaic Systems, MIS 3002 good-practice handover and maintenance principles, relevant manufacturer requirements and insurer requirements.

The contractor shall provide or enable continuous or regular monitoring where feasible, support in-house monitoring where adopted by the purchaser/operator, annual visual and operational inspection, periodic electrical testing, clear fault response arrangements and cleaning recommendations only where technically and financially justified.”

Reference sources used to inform this draft

- BSI Knowledge: BS EN IEC 62446-2:2020 – Photovoltaic (PV) systems. Requirements for testing, documentation and maintenance – Grid connected systems – Maintenance of PV systems.
- IET: Code of Practice for Grid-connected Solar Photovoltaic Systems, 2nd Edition, 2022.
- Solar Energy UK: Rooftop Operations & Maintenance Best Practice Guidelines.
- Welsh Government: Renewables – operation, monitoring and maintenance contracts.
- SolarPower Europe: Operation & Maintenance Best Practice Guidelines.
- MCS: MIS 3002 Issue 5.0 – The Solar PV Standard (Installation), used as a good-practice reference for commissioning, handover, maintenance information, monitoring and contractor competence.