MAYOR OF LONDON

Zero Carbon Accelerator

Commissioning and Handover Guidance

Template for NHS Healthcare Estates

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1 Introduction

This document has been developed as part of the Mayor of London's Zero Carbon Accelerator programme, which supports public sector organisations to accelerate the energy transition of their London buildings, delivering decarbonisation projects across the sector, including on and for NHS healthcare estates.

Developed as part of a direct package of support provided by the Zero Carbon Accelerator to an NHS Trust, this document is intended as guidance/support for other organisations delivering solar PV installations and will be of particular use for other NHS Trusts and healthcare bodies.

This document provides guidance to support the commissioning and handover of solar PV systems on buildings, with the aim of promoting safe, compliant, and consistent delivery. It outlines minimum expectations for standards, commissioning activities, and handover documentation, and is designed to be adaptable to different project scales, sites, and governance arrangements.

This guidance should be read alongside current legislation, relevant British Standards, MCS requirements, and individual sectoral and organisational policies and procedures, and should be tailored as necessary to reflect project and site-specific requirements.

1.1 Caveats and Limitations

This guidance is provided for reference and support only and does not remove the need for project-specific design development, site-specific risk assessments, or compliance with current legislation, standards, and Trust policies. Each organisation remains responsible for ensuring that any solar PV project is delivered in accordance with its own governance arrangements and statutory obligations. Where conflicts arise, the more onerous requirement shall apply.

2 Relevant Standards

This document takes the approach that all solar PV installation should comply with MCS standards and British regulations in accordance with, but not limited to, the following documentation:

- All relevant MCS guidance and documentation including:
  - *MCS 012: Solar Mounting Standard Issue 3.0.*
  - *MIS 3002: Solar PV installation Standard Issue 5.0*
  - *MCS Handover Checklist*
- The latest version of BS 7671 2018 IET Wiring Regulations 18th Edition, 2nd amendment or later.
- IET Code of Practise for Grid Connected Solar Photovoltaic System Second Edition 2022 (ISBN 978-1-83953-751-6 Electronic)

The Client supplied site specifications and documentation should be read in conjunction with the above relevant "standards" documentation.

3 Site Installation Expectations

3.1 External

When choosing a location for the array/s on public buildings, evidence that potential falling panels from the array / snow dislodgment should be considered and risk assessed. A plan should be in place which complies with working at height current regulation to access the roof during the install and future maintenance. There should be a suitably sized working platform to enable safe installation and maintenance in front of the area of installation, with a walkway between the access point to the area with the equipment installed. To be safe and maintain the system the area needs to be lit, to BS EN 12464-1:2021 for Emergency Lighting Requirements in commercial properties. In addition, adequate clear space should be ensured in-front of the equipment to enable comfortable access to all equipment.

3.1.1 Roof Anchors

The specification and quantity of roof anchors should be determined independently for each property based on snow/wind/structural calculations.

Roof anchors should be appropriate for the specific property's roof construction, metal sheeted, rooftiles or slates. If tiles or slates, the installation should not be displaced creating gaps greater than those pre-existing the installation. Any roof tile or slate that is cracked or damaged during the installation should be replaced on a like-for-like basis, preferably at no additional cost to the Client.

3.1.2 A-frames

If the PV panels are to be mounted on a flat roof, the designer/contractor should carry out a full feasibility of the additional loading requirements to the structure. This will help to ensure that the mounting system will not compromise the building structure. If additional structural work is required to mount the system on a pitched roof, then a qualified structural engineer should be employed to assess the required change and sign off that the work has been done to the correct standards (BS 5534 and 8000-6 relate to design, specification, and installation).

3.1.3 Bird protection

A bird-proofing system shall be provided around the perimeter of the PV module array/s and cover all positions where a bird could get below the PV modules. Proprietary retaining clips shall be provided to hold any mesh firmly in place. The contractor shall ensure that any fixing method does not impact the warranty of the PV system.

3.1.4 Roof Penetrations

Roof penetration should be avoided if practicable, but if required they should be durably sealed using purpose-made products capable of accommodating movement and temperatures to which they may be subjected. In all circumstances the property's weather tightness should be maintained. Purpose-made roof tiles and/or flashings should be used for all DC wires routing through the roof.

3.1.5 DC Wiring

The contractor shall size conductors in accordance with the system design and current-carrying capacity requirements. DC cabling shall be XLPE-insulated, UV- and weather-resistant, and suitable for high-temperature operation.

All cables and connectors shall be securely fixed beneath the array to prevent water ingress and avoid any live components being exposed or sitting in pooled water. Connectors and wiring shall comply with BS EN 50618 and IEC 62852, with a minimum protection rating of IP67.

Routing of DC wires shall be carefully considered, not be run through the building as far as reasonably practicable. Additional mechanical protection shall be provided when this cannot be avoided.

Where multiple cables come together along the same route, cable trays should be installed to keep cables tidy and protected.

3.1.6 Environmental

Ingress protection of all equipment shall be adequate for the environment. This may require additional protection to reduce the ingress of dust, dirt and rainwater. Electrical control systems and inverters can suffer overheating due to poor or failed ventilation or inadequacy of cooling systems. Fire is a direct possibility resulting from overheating of equipment and associated cabling, electrical faults, and short circuiting.

3.1.7 End Caps, End Plates

These should be present and correctly fitted.

3.1.8 Panel Fixing

All securing plates should be present, correctly orientated and a torque wrench used to ensure panels are locked onto the subframes securely.

3.1.9 Access requirements (External)

A suitably sized, level, and secure working platform shall be provided to ensure safe installation and maintenance in front of the external equipment. A designated walkway shall be maintained between the primary access point and the equipment location, constructed to provide safe passage under all weather conditions (e.g. anti-slip surfaces, drainage provision).

The area shall be adequately illuminated in accordance with BS EN 12464-2:2014 – Lighting of Workplaces – Outdoor Workplaces, including emergency lighting where required for safety during night-time access or maintenance operations.

Adequate clear working space shall be maintained around all equipment to allow safe and comfortable access for inspection, operation, and maintenance, in compliance with CIBSE Guide F and The Work at Height Regulations 2005.

3.2 Internal

Inverters shall be installed in a non-combustible, well-ventilated area, free from any combustible storage materials. Although current MCS standards do not explicitly prohibit installation within combustible roof voids, such locations present a potential fire risk and are considered poor practice. Installation within combustible voids should therefore be avoided wherever possible.

The contractor shall advise the Client on suitable internal installation locations and confirm the final arrangement in writing, ensuring compliance with manufacturer's recommendations, BS 7671, and MCS requirements.

3.2.1 Fire considerations

Where any internal solar-related components are installed, these shall be mounted on a fire-retardant surface or backboard to ensure all equipment is securely fixed. The area in which the inverter is installed shall include a smoke detector integrated into the existing fire detection system in accordance with BS 5839. A thermal or heat load assessment shall be carried out to confirm the suitability of the inverter location and to ensure adequate ventilation and operating temperature control.

All cable-penetrations through fire compartmentations should maintain the fire rating of that compartment in line with the fire strategy of the building. These must be specified and installed by an accredited fire stopping company. Details of the materials used to create the fire seal should be recorded in the O & M Manual.

A fire-fighter's label shall be affixed at the main AC isolation point, in accordance with MCS guidance. All DC isolators shall also be clearly labelled to identify the array disconnection, but fire-fighter labelling is typically not required for DC isolators unless otherwise specified by the local authority or fire safety requirements.

3.2.2 Access requirements (Internal)

There should be a suitably sized working platform to enable safe installation and maintenance in front of the area of installation, with a walkway between the access point to the area with the equipment installed. To be safe and maintain the system the area needs to be lit, to BS EN 12464-1:2021 for Emergency Lighting Requirements in commercial properties. In addition, adequate clear space should be ensured in-front of the equipment to enable comfortable access to all equipment.

3.2.3 Generation Meter

The contractor should inspect the existing energy meter and assess its suitability for the installation of the solar PV system. Note, there is a risk associated with certain meters that they will run backwards when exporting electricity to the grid.

Where a meter is deemed to be unsuitable, the Client shall be informed so that they can arrange for the meter to be upgraded by their energy provider.

The generation meter should be installed at eye level in a safe weatherproof area where it can be read without the requirement of tools, torch, or ladders.

3.2.4 Labelling and Signage

All labelling through the installation should meet or exceed the requirements of MCS MS3002 standards. Attach a solar 'Fire and Rescue Notification' sticker to the fire control panel for the building. In addition to this, there should be solar PV system start-up and shutdown procedures, emergency contact and full document pack in a wall-mounted receptacle adjacent to the main incoming and solar switchboards. Other boards in the circuit between the Main incomer and the solar Connection board also need a "Dual Supply" sticker.

4 Commissioning Guidance

4.1 Electrical Testing

Electrical installation and connections work undertaken by the contractor must be carried out by a qualified competent Electrical Engineer* in accordance with BS7671 and BS7671 section 712 and MIS 3002. The associated commissioning documentation must be filled in by the same competent person who is familiar with the full electrical installation on site.

Note: Competent Electrical Engineers – such as those recognised in the UK by the NICEIC, the Electrical Contractors Association (ECA)*

4.2 Photographs of the Installation

As a minimum the Client should require the following photos to be submitted with the documentation once the installation has been completed for comment and review:

1. Roof before any work has started.
2. Fixing bracket arrangements
3. View of the rails and bracket with no panel fitted.
4. Panel data plate
5. Roof with all the panels fitted.
6. Internal LV electrical equipment installed including internal breakers/isolation panels and newly installed accessible isolation points for both AC and DC circuits
7. DC Cable runs
8. AC cable runs
9. Generation meter showing serial number.
10. Export meter as required showing serial number
11. Inverter data name plate
12. Solar Distribution board after connection with all labels and signage visible
13. Other Switchboards in a direct circuit between main incomer and olar connection board with label and signage visible
14. Fire control panel with label visible
15. Other installed safety equipment including man safe systems, edge protection, fire stopping, hazard notifications etc
16. Other installed protection and automated isolation equipment with name plates / serial number as applicable.

4.3 District Network Operator (DNO) and Energy Provider

The contractor should be responsible for contacting and completing all documentation to connect the PV system to the grid.

The DNO will require information in advance of the installation and no connection of a solar PV system is permitted until it is approved by the DNO. The DNO needs to be informed so that they can assess the potential impact on their network and determine any works required to support the connection.

***Note**: Connecting single or multiple phase generators at multiple premises of up to 16A (3.68kW) per phase, you need to complete a G98 connection application form before you*

can connect. If you are connecting large scale generation, above 16A (3.68kW) per phase or energy storage, then you will need to complete a G99 connection application form.

5 Required Handover Documentation

The contractor should provide the following handover documentation:

- MCS Certificate if under 50kW or if over 50kW a certificate containing the following as a minimum:
    - Date and signature of the commissioning engineer.
    - A statement confirming that the solar PV system has been installed in line with the requirements set by MCS Standards.
    - Client name and address.
    - Site address (if different).
    - Installer name, address etc.
    - List of key components installed.
    - Estimation of system performance.

- Copy of Invoice – Marked 'Paid in Full'.

- Warranty details including start date and duration.

- The maintenance requirements in the form of detailed Operations & Maintenance Manuals (O&M), including periodic cleaning and inspection schedules (refer also to O&M data below)

- Installed Hardware (as built) Data Required:
    - A single line electrical schematic.
    - Solar Array layout drawing.
    - Any additional drawings cable routing etc
    - Structural and loading Wind/Snow calculations on installed array(s).
    - A copy of the manuals and data sheets for the following system components along with part numbers fitted and their serial numbers:
        - PV modules.
        - Inverter.
        - Battery/s (if applicable).
        - Mounting equipment used.
        - DC Isolators (fireman switch).
        - Installed meters
        - Dataloggers / displays
        - Addition key components which effect the function and/or the safety of the installation.

- Normal operation description and explanation of any common alarms/error messages along with a user-friendly fault-finding guidance associated with the inverter operation.

- Test Results and Commissioning Data:
    - A copy of the AC BS7671 certificate and DC string test result as described in MCS Solar PV installation MIS 3002
    - Test and commissioning documentation.

        - Table of inverter protection settings (under/over voltage, under/over frequency, etc.).

    - Operation & Maintenance (O&M) Data:
        - Procedures for verifying correct system operation.
        - A checklist of what to do in case of a system failure.
        - Shutdown/isolation and start-up procedures.
        - Maintenance & cleaning recommendations.
        - Considerations for any future building works adjacent to the PV array (e.g. roof works) to avoid potential damage or shading of the PV array.

Note: *The above list has been adapted from the IET code of practice for grid-connected solar photovoltaic systems - Section 17 Documentation.*

6 Available Checklists

A checklist summarising the Commercial Installation requirements from SolarEdge and relevant documents from the MCS, can be found on the following links:

- SolarEdge Commercial Installation Checklist - https://knowledge-center.solaredge.com/sites/kc/files/checklist-installation-commercial.pdf
- MCS - Solar PV Installations - https://mcscertified.com/standards-tools-library/?standard_type=new