

Regulated Qualification Framework (RQF)

Qualification Specification for the Level 3 Award in the Installation and Maintenance of Small Scale Solar Photovoltaic Systems

1.0 Qualification Objectives

The objective(s) of the qualification are to:

1. Prepare learners to progress to a qualification in the same subject area but at a higher level or requiring more specific knowledge, skills and understanding
2. Support a role in the workplace.

2.0 Prior qualifications, knowledge, skill or understanding which learners are required to have achieved before taking the qualification

This qualification is aimed at experienced and practicing electrical operatives. On application for the qualification, the Approved Centre (AC) will carry out an Initial Assessment of the learner's capability to complete the qualification.

Learners holding the following will confirm their suitability to enrol on the qualification.

- Level 3 Electrotechnical vocational qualification which includes the initial verification and certification of electrical installations, and a
- BS 7671 Requirements for Electrical Installations (current edition) qualification.

Learners not holding the above qualifications, will be required to provide evidence to the AC of suitable alternative qualifications and/or provide confirmation of their related work experience, skills and knowledge of current electrical regulations. This evidence must be documented and retained by the AC.

Note:

For learners to meet the membership requirements of any competent person scheme, registration body or other professional recognition there may be additional requirements.

3.0 Other requirements which a learner must have satisfied before the learner will be assessed or before the qualification will be awarded

None.

4.0 Qualification Framework

The qualification comprises of 4 mandatory units.

Unit Title	Unit Reference Number	Type of Unit	Level	Credit Value
Know the requirements to install, commission and handover small scale solar photovoltaic systems	LCL-R3010	Knowledge	3	1
Install, commission and handover small scale solar photovoltaic systems	LCL-R3011	Performance	3	1
Know the requirements to inspect, service and maintain small scale solar photovoltaic systems	LCL-R3012	Knowledge	3	1
Inspect, service and maintain small scale solar photovoltaic systems	LCL-R3013	Performance	3	1

4.1 Qualification Time and Credit Value

- The Total Qualification Time (TQT) is 35 hours
- The Guided Learning Hours (GLH) are 35
- The total Credit Value of the qualification is: 4.

4.2 Qualification Level

The qualification has been assigned at level: 3.

4.3 Grading Structure

The grading structure for the qualification is that learners are required to achieve a result of **Pass** to be awarded credit for each unit.

This qualification will be achieved when learners have successfully completed:

- The LCL Awards set and marked multiple choice knowledge examination
- The LCL Awards set and AC marked performance assessments.

4.4 Assessment Method

The assessment methods within the qualification include an on-screen multiple choice knowledge examination and AC marked performance assessment.

The assessment method has been designed to assess the knowledge, understanding and skills of learners.

The on-screen multiple choice examination is set and marked by LCL Awards.

The performance assessment is set by LCL Awards and marked by an LCL Awards approved assessor at the AC.

5.0 The criteria against which learners' level of attainment will be measured

The Learning Outcomes and Assessment Criteria against which learners' level of attainment will be measured are detailed in the examination and assessment specification for each unit below.

Unit Learning Outcomes and Assessment Criteria

LCL-R3010: Know the Requirements to Install, Commission and Handover Small Scale Solar Photovoltaic Systems.

Learning Outcome 01. The learner will know the health and safety risks and safe systems of work associated with solar photovoltaic (SPV) system work.

The learner will demonstrate knowledge of:

- 1.1 Which aspects of solar photovoltaic system work pose risk of:
 - Electrocution/electric shock
 - Burns
 - Fall from height
 - Injury though component/equipment handling.
- 1.2 Safe systems of work for solar photovoltaic system work in relation to prevention of:
 - Electrocution/electric shock
 - Burns
 - Fall from height
 - Injury though component/equipment handling.

Learning Outcome 02. The learner will know the requirements of the relevant regulations and standards relating to the installation, testing and commissioning activities of SPV system installation work.

The learner will demonstrate knowledge of:

- 2.1 Building regulations and building standards guidance as relevant to solar photovoltaic system installation work in relation to:
 - Maintaining the structural integrity of the building
 - Maintaining the fire-resistant integrity of the building
 - The prevention of moisture ingress (building integrity)
 - Notification of works
 - Electrical safety
 - Energy conservation.
- 2.2 Electrical wiring regulation requirements relevant to solar photovoltaic system work in relation to:
 - System installation
 - Inspection and testing
 - Commissioning.

Learning Outcome 03. The learner will know the fundamental differences between AC and DC circuits within SPV systems.

The learner will demonstrate knowledge of:

3.1 The fundamental differences between AC and DC circuits within solar photovoltaic systems in relation to:

- Voltage
- Current
- Safe isolation
- Selection of appropriate system components.

Learning Outcome 04. The learner will know the purpose of SPV system components.

The learner will demonstrate knowledge of:

4.1 The purpose and function of the following solar photovoltaic system components:

- Photovoltaic module
- Module mounting systems
- DC cables and wiring systems
- PV connectors
- DC isolator
- Inverter
- AC isolators
- AC cables and wiring systems
- AC distribution board
- Generation meter
- Warning notices and labels.

Learning Outcome 05. The learner will know the types, characteristics and typical conversion efficiencies of SPV modules.

The learner will demonstrate knowledge of:

5.1 The following types of solar photovoltaic module:

- Non-integrated photovoltaic module
- Thin film photovoltaic module
- Integrated (slate or tile) photovoltaic module
- Building integrated photovoltaic module.

5.2 The characteristics of:

- Monocrystalline photovoltaic modules
- Polycrystalline and multicrystalline photovoltaic modules
- Thin film photovoltaic modules.

5.3 The relevant manufacturing compliance requirements for:

- Crystalline type modules
- Thin film type modules.

5.4 The typical conversion efficiencies associated with:

- Monocrystalline photovoltaic modules

- Polycrystalline/multicrystalline photovoltaic modules
- Thin film photovoltaic modules.

Learning Outcome 06. The learner will know the fundamental design principles used to determine SPV system module array size and position requirements.

The learner will demonstrate knowledge of:

- 6.1 The information required to enable solar photovoltaic array design in relation to:
 - Building design
 - Building dimensions and angles
 - Building location and orientation
 - Building fabric and material details.
- 6.2 How to calculate the nominal power (kWp) per m² of a given product.
- 6.3 How annual solar photovoltaic electrical output (kWh) can be affected by:
 - Geographical irradiation levels
 - The array mounting angle
 - The array orientation
 - Shading of the array or modules within the array.
- 6.4 The potential effect of shading on:
 - Solar photovoltaic module condition
 - Solar photovoltaic array condition.
- 6.5 The potential benefit(s) of incorporating a solar tracker into the system design.

Learning Outcome 07. The learner will know the preparatory work required for SPV system installation work.

The learner will demonstrate knowledge of:

- 7.1 The requirements of pre-installation checks in relation to:
 - Authorisation for the work to proceed
 - The availability of appropriate access to all required work areas
 - The inspection and testing of existing electrical installations
 - The proposed siting of key internal system components
 - The suitability of the building structure in relation to the proposed installation
 - The suitability of the proposed location and position of the PV modules for optimum collection capacity
 - The suitability of the building fabric in relation to the installation of the PV modules.

Learning Outcome 08. The learner will know the layouts and the requirements for installing SPV module arrays.

The learner will demonstrate knowledge of:

- 8.1 The following solar photovoltaic system module array layouts:
 - Single array, single string
 - Single array, multiple string
 - Multiple array, multiple string.

- 8.2 The requirements for handling, moving and storing solar photovoltaic modules
- 8.3 The requirements for fixing 'on roof' solar photovoltaic modules to pitched roof slopes
- 8.4 The requirements for fixing 'in roof' solar photovoltaic modules to pitched roof slopes
- 8.5 The requirements for fixing solar photovoltaic modules using secondary frame structures
- 8.6 The requirements for ventilation in relation solar photovoltaic modules/module arrays
- 8.7 How to achieve durable weather-tightness of buildings where array cables pass through the building fabric
- 8.8 The safety requirements that must be applied when a solar photovoltaic array has been installed prior to the installation of other system components
- 8.9 The requirements for connecting solar photovoltaic modules in a single string array
- 8.10 The requirements for connecting solar photovoltaic modules with multiple string array
- 8.11 How to check that string voltages and currents are suitable for the:
 - Inverter rating
 - Overall system installation.
- 8.12 The requirements for cable routing within solar photovoltaic module arrays in relation to:
 - Avoidance of inductive loops
 - Other requirements.
- 8.13 The correct sequence of work to minimise the risk of injury through electrocution.

Learning Outcome 09. The learner will know SPV system DC and AC circuit installation layouts within the scope of the relevant Engineering Recommendations for grid tied systems.

The learner will demonstrate knowledge of:

- 9.1 The industry approved DC and AC circuit layout for single array systems connected to single-phase installations
- 9.2 The industry approved DC and AC circuit layout for single array systems connected to polyphase installations.

Learning Outcome 10. The learner will know SPV system protection methods and components.

The learner will demonstrate knowledge of:

- 10.1 The methods and components used to protect the DC system and users of, against:
 - Electric shock
 - Overcurrent
 - Overvoltage
 - Frequency variations.
- 10.2 The methods and components used to protect the AC system and users of, against:
 - Electric shock
 - Overcurrent
 - Overvoltage
 - Frequency variations.

Learning Outcome 11. The learner will know the requirements to test and commission SPV systems.

The learner will demonstrate knowledge of:

- 11.1 The pre-commissioning procedures and/or requirements for a solar photovoltaic system in relation to:
 - Compliance with relevant installation instructions/regulatory requirements
 - Compliance with the system design
 - The security and integrity of system components
 - The provision of adequate ventilation for system components
 - Electrical safety
 - Electrical overcurrent protection arrangements.
- 11.2 The regulatory and industry pre-commissioning test requirements for the AC circuit within a solar photovoltaic system
- 11.3 The regulatory and industry pre-commissioning test requirements for the DC circuit within a solar photovoltaic system
- 11.4 The conditions that are required to implement commissioning and activities for solar photovoltaic systems
- 11.5 The regulatory and industry requirements for the commissioning of the AC circuit within a solar photovoltaic system
- 11.6 The regulatory and industry requirements for the commissioning of the DC circuit within a solar photovoltaic system.

Learning Outcome 12. The learner will know the requirements to handover SPV systems.

The learner will demonstrate knowledge of:

- 12.1 The pre-handover checks that need to be carried out for solar photovoltaic systems
- 12.2 The recommended industry handover procedures for solar photovoltaic systems in relation to the:
 - Provision of written information
 - Provision of diagrammatic information
 - Provision of verbal information/demonstration relating to system operation and use.

LCL-R3011: Install, Commission and Handover Small Scale Solar Photovoltaic Systems.

Learning Outcome 01. The learner will plan and prepare for the installation of a SPV system.

The learner will be able to:

- 1.1 Undertake pre-installation checks in relation to:
 - Authorisation for the work to proceed
 - The availability of appropriate access to all required work areas
 - The inspection of existing electrical installations
 - The proposed siting of key internal system components
 - The suitability of the building structure in relation to the proposed installation

- The suitability of proposed location of the PV modules for optimum collection capacity
 - The suitability of the building fabric in relation to the installation of the PV modules.
- 1.2 Confirm that the tools, materials and equipment required for the installation work are available and are in a safe usable condition.

Learning Outcome 02. The learner will be able to install SPV system components.

The learner will be able to:

- 2.1 Install a solar photovoltaic array in accordance with:
- Manufacturer's requirements and guidance
 - Regulatory requirements
 - Industry recognised procedures
 - Building Regulations/Standards.
- 2.2 Install a solar photovoltaic DC circuit in accordance with manufacturer's requirements and guidance, regulatory requirements and industry recognised procedures to include connection of the following components:
- DC isolator
 - Inverter
 - DC cabling from PV module(s) to DC isolator
 - DC cabling from DC isolator to inverter.

Learning Outcome 03. The learner will be able to inspect and test a new SPV system installation.

The learner will be able to:

- 3.1 Inspect and test the AC circuit in accordance with the design specification, manufacturer's requirements and the relevant regulatory requirements
- 3.2 Inspect and test the DC circuit in accordance with the design specification, manufacturer's requirements and the relevant regulatory requirements
- 3.3 Complete relevant inspection, testing and certification records in accordance with manufacturer's requirements and the relevant regulatory requirements.

Learning Outcome 04. The learner will be able to commission a new SPV system installation.

The learner will be able to:

- 4.1 Undertake relevant pre-commissioning checks in accordance with the design specification, manufacturer's requirements and the relevant regulatory requirements
- 4.2 Identify the design requirements, manufacturer's requirements, client's requirements regulatory requirements and industry requirements for the commissioning of the system
- 4.3 Confirm that conditions are suitable to implement commissioning procedures
- 4.4 Commission the system in accordance with design requirements, manufacturer's requirements, client's requirements, regulatory requirements and industry requirements for the commissioning of the system
- 4.5 Complete relevant documentation to record the commissioning activities in accordance with manufacturer's requirements and the relevant regulatory requirements.

Learning Outcome 05. The learner will be able to hand over a new SPV system installation.

The learner will be able to:

- 5.1 Explain and demonstrate to the end user the operation and use of the system using manufacturer's guidance and industry agreed handover procedures
- 5.2 Identify and explain to the end user any aspects of the system that varies from the agreed specifications and requirements
- 5.3 Obtain acceptance by the end user of the system according to the industry agreed handover procedures
- 5.4 Ensure that all relevant handover documentation is correctly completed and recorded in the appropriate information systems and passed to the end user in accordance with manufacturer's guidance and industry recognised procedures.

LCL-R3012: Know the Requirements to Inspect, Service and Maintain Small Scale Solar Photovoltaic Systems.

Learning Outcome 01. The learner will know the requirements for the routine inspection, service and maintenance of SPV system installations.

The learner will demonstrate knowledge of:

- 1.1 The documentation needed to enable a routine service and maintenance inspection
- 1.2 The typical routine service and maintenance requirements in relation to:
 - Visual inspection requirements
 - Cleaning of components
 - Safe condition testing
 - Functional testing
 - Performance testing
 - Adjustment of controls/components.
- 1.3 The recording and reporting requirements for routine maintenance work.

Learning Outcome 02. The learner will know how to diagnose faults in SPV system installations.

The learner will demonstrate knowledge of:

- 2.1 The information that needs to be available to enable fault diagnosis
- 2.2 The work actions and sequences required to diagnose the following faults:
 - Loss of full collection capacity
 - Loss of output from inverter
 - Loss of AC supply circuit to inverter
 - No output from DC circuit
 - Broken or damaged PV module
 - Cable failure within DC circuit.

Learning Outcome 03. The learner will know how to rectify faults in SPV systems.

The learner will demonstrate knowledge of:

3.1 The work actions and sequences required to rectify the following faults:

- Loss of full collection capacity
- Loss of output from inverter
- Loss of AC supply circuit to inverter
- No output from DC circuit
- Broken or damaged PV module
- Cable failure within DC circuit.

LCL-R3013: Inspect, Service and Maintain Small Scale Solar Photovoltaic Systems.

Learning Outcome 01. The learner will undertake the routine service and maintenance of a SPV system installation.

The learner will be able to:

1.1 Obtain the relevant information required to enable the work

1.2 Undertake, a visual service and maintenance inspection to include checks in relation to:

- Compliance with manufacturer's installation instructions
- Compliance with statutory regulations
- The condition of system components
- The correct positioning of system components
- The security of fixing of system components
- The provision of adequate ventilation of system components.

1.3 Undertake, routine servicing of relevant system components to include:

- Cleaning of systems components
- Checking and adjustment of system controls.

1.4 Undertake routine service and maintenance tests to include:

- Tests required under statutory regulations
- Tests to confirm the correct operation of system safety devices
- Tests to confirm the correct operation of system controls
- Checks and actions to confirm the optimum performance of the PV array(s).

1.5 Complete the relevant service and maintenance records in accordance with industry recognised procedures.

Learning Outcome 02. The learner will be able to undertake fault diagnosis work on SPV system installations.

The learner will be able to:

2.1 Identify the information that needs to be available to enable fault diagnosis

2.2 Identify using safe systems of work, the cause of a range of separate faults from the following list:

- Loss of full collection capacity
- Loss of output from inverter
- Loss of AC supply circuit to inverter
- No output from DC circuit

- Broken or damaged solar PV module
- Cable failure within DC circuit.

2.3 Agree with the relevant person(s) fault rectification procedures for the faults identified.

Learning Outcome 03. The learner will be able to undertake fault rectification work on SPV system installations.

The learner will be able to:

3.1 Take relevant precautionary actions to prevent unauthorised use of the system prior to or during the fault rectification work

3.2 Take relevant precautionary actions to minimize the risk of injury to self or others during the fault rectification work

3.3 Rectify, using safe systems of work, a range of separate faults from the following list:

- Loss of full collection capacity
- Loss of output from inverter
- Loss of AC supply circuit to inverter
- No output from DC circuit
- Broken or damaged solar PV module
- Cable failure within DC circuit.

3.4 Undertake post-rectification tests in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures to confirm that the system is in a safe, functional and efficient condition.

6.0 Other Information

Qualification Regulator Numbers:

- Ofqual 600/5775/0
- Qualification Wales C00/2509/6

Sector Skills Area: SSAs: 5.2 Building and Construction.

Suitable for age 16+.

Last Qualification Review Date: February 2024

Next Qualification Review Date: 28.02.2027