

# REGULATED QUALIFICATION FRAMEWORK (RQF)

## QUALIFICATION SPECIFICATION

- **LCL Awards LEVEL 3 AWARDS IN THE INSTALLATION AND MAINTENANCE OF SMALL SCALE SOLAR PHOTOVOLTAIC SYSTEMS**

### 1. Objective:

The objective of the qualification is for learners to demonstrate they are competent in accordance with legislation, regulations and industry standards covering the safe installation of a photovoltaic system.

1. Know the requirements to install, commission and handover small scale solar photovoltaic systems
2. Install, commission and handover small scale solar photovoltaic systems
3. Know the requirements to inspect, service and maintain small scale solar photovoltaic systems
4. Inspect, service and maintain small scale solar photovoltaic systems

### 2. This qualification comprises of 4 Mandatory Units; (section 4.0)

Unit Title	Type of Unit	LCL- REF	Level	Credit Rating
<u>Know the requirements to install, commission and handover small scale solar photovoltaic systems</u> D/602/3086	Knowledge	LCL-R3010	3	1
<u>Install, commission and handover small scale solar photovoltaic systems</u> K/602/3088	Performance	LCL-R3011	3	1
<u>Know the requirements to inspect, service and maintain small scale solar photovoltaic systems</u> M/602/3089	Knowledge	LCL-R3012	3	1
<u>Inspect, service and maintain small scale solar photovoltaic systems</u> M/602/3092	Performance	LCL-R3013	3	1
				4

### LCL Awards LEVEL 3 AWARDS IN THE INSTALLATION AND MAINTENANCE OF SMALL SCALE SOLAR PHOTOVOLTAIC SYSTEMS

- The Guided Learning Hours (GLH) are **35 hours**
- The Total Qualification Time (TQT) is **35 hours**
- The total credit required to achieve the qualification is **4**
- **QAN 600/5775/0**
- **QW C00/2509/6**

### 3. Grading Structure:

The Learner is required to achieve a result of **PASS** for each unit for the qualification to be awarded.

#### 4. Qualification Structure:

1. 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 system installation work.**

**Assessment Criteria – The learner can:**

1.1 Identify which aspects of solar photovoltaic system installation work pose risk of:

- electrocution/electric shock
- burns
- a fall from height
- personal injury through component/equipment handling.

1.2 Identify **safe systems of work** for solar photovoltaic system installation work in relation to prevention of:

- electrocution/electric shock
- burns
- a fall from height
- personal injury through component/equipment handling.

**Learning Outcome 02. The learner will know the requirements of the relevant regulations/ standards relating to practical installation, testing and commissioning activities for solar photovoltaic system installation work.**

**Assessment Criteria – The learner can:**

2.1 Identify which building regulation/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 water tightness)
- notification of works
- electrical safety
- energy conservation

2.2 Interpret industry recognised electrical wiring regulation requirements as relevant to solar photovoltaic system installation work in relation to:

- system installation
- inspection and testing
- commissioning.

**Learning Outcome 03. The learner will know the fundamental differences between A.C and D.C circuits within solar photovoltaic systems.**

**Assessment Criteria – The learner can:**

3.1 Identify the fundamental differences between A.C and D.C circuits within solar photovoltaic systems in relation to:

- voltages
- safe isolation
- selection of appropriate system components.

**Learning Outcome 04. The learner will know the purpose of solar photovoltaic system components.**

**Assessment Criteria – The learner can:**

4.1 identify the purpose/function of the following solar photovoltaic system components:

- photovoltaic module
- module mounting systems
- D.C. cabling
- PV connectors
- blocking diodes
- D.C. isolator
- D.C. fuses
- D.C. junction box
- Inverter
- A.C. isolators
- A.C. distribution board
- generation meter
- generation display unit
- labels.

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

**Assessment Criteria – The learner can:**

5.1 Identify the following types of solar photovoltaic module:

- 'On roof' photovoltaic module
- thin film photovoltaic module
- 'In roof' (slate or tile) photovoltaic module
- building integrated photovoltaic module.

5.2 Confirm the characteristics of:

- monocrystalline photovoltaic modules
- polycrystalline/multicrystalline photovoltaic modules
- thin film photovoltaic modules.

5.3 State the relevant manufacturing compliance requirements for:

- crystalline type modules
- thin film type modules.

5.4 State 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 solar photovoltaic system module array size and position requirements.**

**Assessment Criteria – The learner can:**

6.1 Confirm the information required to enable solar photovoltaic array design in relation to:

- building design
- building dimensions/angles
- building location and orientation
- building fabric/material details.

6.2 Confirm how to calculate the nominal power (kWp) per m<sup>2</sup> of a given product.

6.3 Identify how annual solar photovoltaic electrical output (kWh) can be affected by:

- geographical irradiation levels
- the array mounting angle
- the array orientation
- over shading of the array or modules within the array.

6.4 Identify the potential effect of shading on:

- solar photovoltaic module condition
- solar photovoltaic array condition.

6.5 Identify 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 solar photovoltaic system installation work.**

**Assessment Criteria – The learner can:**

7.1 Identify 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 solar photovoltaic module arrays.**

**Assessment Criteria – The learner can:**

8.1 Identify the following solar photovoltaic system module array layouts:

- single array, single string
- single array, multiple string.

8.2 Identify the requirements for handling, moving and storing solar photovoltaic modules.

8.3 Identify the requirements for fixing 'on roof' solar photovoltaic modules to pitched roof slopes.

8.4 Identify the requirements for fixing 'in roof' solar photovoltaic modules to pitched roof slopes.

8.5 Identify the requirements for fixing solar photovoltaic modules using secondary frame structures.

8.6 Identify the requirements for ventilation in relation solar photovoltaic modules/module arrays.

8.7 Identify how to achieve durable weather-tightness of buildings where array cables pass through the building fabric.

8.8 Identify 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 Identify the requirements for connecting solar photovoltaic modules in a single string array.

8.10 Identify the requirements for connecting solar photovoltaic modules with multiple string array.

8.11 Confirm how to check that string voltages and currents are suitable for the:

- inverter rating
- overall system installation.

8.12 Identify the requirements for cable routing within solar photovoltaic module arrays in relation to:

- avoidance of inductive loops
- other requirements.

8.13 Identify the correct sequence of work to minimise the risk of injury through electrocution.

**Learning Outcome 09. The learner will know solar photovoltaic system D.C and A.C circuit installation layouts within the scope of the relevant Engineering Recommendation for grid tied systems.**

**Assessment Criteria – The learner can:**

9.1 Confirm the industry approved D.C and A.C circuit layout for single array systems connected to single phase installations

9.2 Confirm the industry approved D.C. and A.C. circuit layout for single array systems connected to three phase installations.

**Learning Outcome 10. The learner will know solar photovoltaic system protection techniques and components.**

**Assessment Criteria – The learner can:**

10.1 Confirm the techniques and components used to protect system and or/building users in relation to:

- D.C. circuit over and under voltage protection
- D.C. circuit over and under current protection.

10.2 Confirm the techniques and components used to protect system and or/building users in relation to:

- A.C. circuit over and under voltage protection
- A.C. circuit over and under frequency protection
- A.C. circuit over and under current protection.

**Learning Outcome 11. The learner will know the requirements to test and commission solar photovoltaic systems.**

**Assessment Criteria – The learner can:**

11.1 Confirm 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 over-current protection arrangements.

11.2 Confirm the regulatory and industry pre-commissioning test requirements for the A.C circuit within a solar photovoltaic system.

11.3 Confirm the regulatory and industry pre-commissioning test requirements for the D.C circuit within a solar photovoltaic system.

11.4 State the conditions that are required to implement commissioning and activities for solar photovoltaic systems.

11.5 Confirm the regulatory and industry requirements for the commissioning of the A.C circuit within a solar photovoltaic system.

11.6 Confirm the regulatory and industry requirements for the commissioning of the D.C circuit within a solar photovoltaic system.

**Learning Outcome 12. The learner will know the requirements to handover solar photovoltaic systems.**

**Assessment Criteria – The learner can:**

12.1 State the pre-handover checks that need to be carried out for solar photovoltaic systems.

12.2 Confirm 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.

**2. Install, Commission and Handover Small Scale Solar Photovoltaic Systems**

**Performance Assessments**

*Where this assessment is conducted in full or in part, either in the work place or a simulated Realistic Work Environment (RWE), the performance assessment must be carried out using installations that will enable the learner to demonstrate competence to install, inspect, test, commission and handover to the end user a Small Scale Solar Photovoltaic Systems, and associated components covered by this assessment and that the assessment will enable the Unit's performance and knowledge assessment criteria to be met.*

### **Workplace Performance Assessments.**

*Work place performance assessments must be undertaken with the learner being directly supervised by a competent person.*

It is the responsibility of the assessor to ensure that;

- The assessment being undertaken by the learner is carried out in accordance with the requirements of prevailing legislation and normative standards at the time of assessment.
- A risk assessment has been carried out by the learner and that the assessment has taken into account and mitigated potential or actual risks either before or during the assessment.
- The supervising engineer holds valid certificates of competence in the areas of work being undertaken by the learner.
- Confirmation has been given by the responsible person of the property for the work to be carried out.

### **Learning Outcome 01. The learner will plan and prepare for the installation of a solar photovoltaic system.**

#### **Assessment Criteria – The learner can:**

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 install solar photovoltaic system components.**

#### **Assessment Criteria– The learner can:**

2.1 Install a solar photovoltaic array in accordance with:

- manufacturer's guidance
- regulatory requirements
- industry recognised procedures

to include 2 panels as a minimum the positioning, fixing and connection of the array

2.2 Install a solar photovoltaic D.C. circuit in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures to include as a minimum



connection of the following components:

- D.C. isolator
- inverter
- D.C. cabling from module(s) to D.C. isolator
- D.C. cabling from D.C. isolator to inverter.

**Learning Outcome 03. The learner will inspect and test a new solar photovoltaic system installation.**

**Assessment Criteria– The learner can:**

3.1 Inspect and test the A.C. circuit in accordance with the design specification, manufacturer’s requirements and the relevant regulatory requirements.

***Note:** For the purpose of simulated assessment only, providing the A.C circuit installation that will be used by the learner for the assessment of AC 3.1 has been satisfactorily inspected and tested by the centre before the commencement of the assessment of AC 3.1, it is not necessary for the learner to undertake assessment relating to this AC as the learner will have demonstrated competence to inspect and test A.C circuits as part of the pre-requisite entry requirements for the qualifications in which this unit features .*

3.2 Inspect and test the D.C. 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 commission a new solar photovoltaic system installation.**

**Assessment Criteria – The learner can:**

4.1 Undertake relevant pre-commissioning checks in accordance with the design specification, manufacturer’s requirements and the relevant regulatory requirements.

4.2 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.

***Note:** For this LO and AC, whilst desirable, it is not essential that the PV array be subjected to real or artificial solar energy during the commissioning activity. In the event that PV array is not subjected to real or artificial solar energy during the commissioning activity, the assessor must identify methods of enabling the commissioning checks to be completed. For example, the use of a portable PV array that can be taken outside may enable some aspects of the commissioning to be effectively undertaken.*

**Learning Outcome 05. The learner will hand over a new solar photovoltaic system installation.**

**Assessment Criteria– The learner can:**

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.

**Note:** The handover documentation provided must align with the requirements of the Microgeneration Certification Scheme (MCS) Microgeneration Installation Standard: MIS 3002

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.

### **3. 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 solar photovoltaic system installations.**

**Assessment Criteria – The learner can:**

1.1 State which documentation needs to be available to enable a routine service and maintenance inspection.

1.2 identify 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 Confirm the recording and reporting requirements for routine maintenance work.

**Learning Outcome 02. The learner will know how to diagnose faults in solar photovoltaic system installations.**

**Assessment Criteria – The learner can:**

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

2.2 Identify the work actions and sequences required to diagnose the following faults:

- loss of full collection capacity
- loss of output from inverter
- loss of A.C. supply circuit to inverter
- no output from D.C. circuit
- broken or damaged solar module
- cable failure within D.C. circuit.

**Learning Outcome 03. The learner will know how to rectify faults in solar photovoltaic systems.**

**Assessment Criteria – The learner can:**

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

- loss of full collection capacity
- loss of output from inverter
- loss of A.C. supply circuit to inverter
- no output from D.C. circuit
- broken or damaged solar module
- cable failure within D.C. circuit.

#### **4. Inspect, Service and Maintain Small Scale Solar Photovoltaic Systems**

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

**Assessment Criteria – The learner can:**

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/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/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 undertake fault diagnosis work on solar photovoltaic system installations.**

**Assessment Criteria– The learner can:**

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

- loss of full collection capacity
- loss of output from inverter
- loss of A.C. supply circuit to inverter
- no output from D.C. circuit
- broken or damaged solar PV module
- cable failure within D.C. circuit.

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

**Learning Outcome 03. The learner will undertake fault rectification work on solar photovoltaic system installations.**

**Assessment Criteria– The learner can:**

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 minimum of **TWO** separate faults from the following list:

- loss of full collection capacity
- loss of output from inverter
- loss of A.C. supply circuit to inverter
- no output from D.C. circuit
- broken or damaged solar PV module
- cable failure within D.C. 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.

## 5. Descriptor Level 3. (RQF)

### Knowledge descriptor:

*Has factual, procedural and theoretical knowledge and understanding of a subject or field of work to complete tasks and address problems that while well-defined, may be complex and non-routine. Can interpret and evaluate relevant information and ideas. Is aware of the nature of the area of study or work. Is aware of different perspectives or approaches within the area of study or work*

### Skills Descriptor:

*Identify, select and use appropriate cognitive and practical skills, methods and procedures to address problems that while well-defined, may be complex and non-routine. Use appropriate investigation to inform actions. Review how effective methods and actions have been*

## 6. Other qualifications which a learner must have completed before taking the qualification.

1. The Level 3 NVQ Diploma in Installing Electrotechnical Systems and Equipment (Buildings & Structures)  
or
2. The N/SVQ 3 Electrotechnical Services (Electrical Installation Buildings & Structures)[Those learners awarded this qualification pre 2008 must provide auditable evidence they have been awarded an accredited and regulated successful assessment certificate for a current BS 7671: Requirements for Electrical Installations (17th Edition)]  
or
3. LCL Level 3 Certificate in Installing Testing and Ensuring Compliance of Electrical Installations in Dwellings 601/7876/0  
or
4. Auditable evidence that demonstrates they have the level of occupation competence that equates with 1 or 2 above, for example;

Qualification recognised by the electrical installation industry plus auditable evidence of relevant experience in the work place (e.g. Signed formal training/assessment log-book/record or employer references) plus (if not covered in the recognised qualification) auditable evidence they have been awarded an accredited and regulated successful assessment certificate for a current BS 7671: Requirements for Electrical Installations (17th Edition).

Recognition of occupational competence by a government recognised Competent Person Scheme (CPS) plus auditable evidence they have been awarded an accredited and regulated successful assessment certificate for a current BS 7671: Requirements for Electrical Installations (17th Edition).

Evidence of recognition of occupational competence by the JIB/SJIB Electrical plus auditable evidence they have been awarded an accredited and regulated successful assessment certificate for a current BS 7671: Requirements for Electrical Installations.

**7. Units which a learner must have completed before the qualification will be awarded and any optional routes.**

Learners must complete the Mandatory units before the qualification will be awarded. See Section 4.0 above.

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

Where detailed in the Unit Specification, the learner must have demonstrated a sufficiency of supervised work practice and gained sufficient experience to enable a successful assessment outcome to be achieved.

**9. The knowledge, skills and understanding which will be assessed as part of the qualification.**

None Applicable

**10. The method of any assessment and any associated requirement relating to it.**

The method of any assessment and any associated requirement relating to it are detailed in the assessment and examination specification for each unit.

The design and delivery of the assessments and examinations associated with this Unit are based on the following documents;

- BS 7671: Requirements for Electrical Installations
- Engineering Recommendation G83: Distributed Generated Connections Guide
- Microgeneration Certification Scheme (MCS) Microgeneration Installation Standards: MIS 3002:
- Manufacturer's Installation and Commissioning Instructions
- Relevant parts of Building Regulations
- MCS/ECA Guide to Installation of PV Systems

Performance Assessment Facilities and Equipment (see centre guidance / facility check list)

**11. 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 assessment and examination specification for the qualification.

**12. Specimen assessment materials.**

Not Applicable

**13. Specified levels of attainment**

Learners must satisfy all Assessment Criteria for all Learning Outcomes within the Units.

Learners must achieve;

- A mark of 75% per question or more to pass the short response written examinations for the qualification to be awarded.
- A mark of 100% to pass the multiple choice examinations for the qualification to be awarded.
- Satisfy all performance assessment criteria for the qualification to be awarded.

#### **14. Other information**

SSAs: 5.2 Building and Construction

Qualification Availability: Shared with BPEC, EAL, C&G

Qualification Review Date: 31 December 2022

## **Assessment and Examination Terminology**

**AC** – *Approved Centre; an examination conducted either at the approved centre or a location approved by the centre, using staff approved by the centre to conduct the examination.*

**CE** – *Customer Evidence; evidence provided by a customer in the form of a written witness statement confirming a competent performance by the learner. That evidence may also be provided by an employing supervisor or manager of the learner. Witness statements that relate to a technical competence will only be accepted from a person technically competent in that particular activity to provide the statement.*

**IK** – *Inferred Knowledge; inferred knowledge is assessed as part of a performance assessment by a centre approved assessor. To deem the learner as having sufficient knowledge the learner must satisfactorily pass the performance assessment.*

**LE** – *Learner Evidence; learner generated evidence is for example documented recordings of readings, calculations or the production of a risk assessment or other procedural document.*

**OP** – *Observed Performance; the assessment of a learner’s performance by an approved assessor either in the learner’s work place or at the approved centre or a location approved by the centre.*

**OQ** – *Oral Questions; oral questions may be asked by an assessor as part of a performance assessment or knowledge examination to confirm the understanding of the criteria by the learner.*

**PA** – *Performance Assessment; a performance assessment conducted either in the learner’s work place or at the approved centre or a location approved by the centre.*

**RWE** – *Realistic Work Environment; an area at the approved centre or a location approved by the centre which replicates and has the features of a Work Place. The learner must not be permitted to be familiar with the simulated environment prior to undertaking assessment.*

**WP** – *Work Place; is the naturally occurring environment in which the learner works, typically that would be in a customer’s premise where work is being paid for by the customer.*

**WQMC** – *Written Question Multi-Choice; multi- choice questions will be set by the awarding organisation and administered and marked locally at the approved centre by approved markers. Learners will be able to answer multi-choice questions using reference to appropriate industry normative or informative sources.*

**WQSR** – *Written Question Short Response; Short response written questions will be set by the awarding organisation and administered and marked locally at the approved centre by approved markers. Learners will be able to answer short response questions using reference to appropriate industry normative or informative sources*

**OB.** - *All LCL assessments are open-book*