

# Qualification Guide

**BPEC 600/6283/6 - Level 3 Award in the Installation and Maintenance of Small Scale Solar Photovoltaic Systems**



# THE L3 AWARD IN THE INSTALLATION AND MAINTENANCE OF SMALL SCALE SOLAR PHOTOVOLTAIC SYSTEMS

## Introduction

This Guide has been produced in conjunction with SummitSkills who have developed the 'National Occupational Standards' and Units of Assessment for the suite of Environmental Technology qualifications (including Solar PV). This guide details the requirements for both centres delivering the L3 Award in the Installation and Maintenance of Small Scale Solar Photovoltaic Systems, and learners undertaking the qualification - and aims to provide:

- An overview of the structure of the qualification
- An overview of the assessment strategy for the qualification
- Guidance notes for assessors and other centre staff for the qualification

The L3 Award in the Installation and Maintenance of Small Scale Solar Photovoltaic Systems requires the completion of both centre based knowledge and practical assessments\* and is designed for individuals carrying out the installation, commissioning, de-commissioning, servicing and maintenance of small scale solar photovoltaic systems.

*\*Workplace-based performance assessments are also available if learners are already actively involved in the installation of PV systems.*

## Contents

Introduction	2
Rules of Combination	3
Unit Details	4
Assessment Requirements	19
Scheme Documentation	21
Staff Qualification Requirements	23
Further Information	26

## Rules of Combination

### Level 3 Award in the Installation and Maintenance of Small Scale Solar Photovoltaic Systems

This is a Level 3 qualification of 10 credits and 80 guided learning hours consisting of 4 mandatory units. ALL units must be achieved to achieve the overall qualification.

Successful completion of this qualification proves that learners are competent to install, commission, decommission, service and small scale solar photovoltaic systems. The qualification and unit details are shown below:

<b>Qualification Title</b>	Level 3 Award in the Installation and Maintenance of Small Scale Solar Photovoltaic Systems				
<b>BPEC Qualification Number</b>	600/6283/6				
<b>Last Registration Date</b>	31/12/2019				
<b>Last Certification Date</b>	31/12/2022				
<b>Unit Ref</b>	<b>Unit Title</b>	<b>Level</b>	<b>Credit Value</b>	<b>TQT</b>	<b>Guided Learning Hours</b>
D/602/3086	Know the requirements to install, commission and handover small scale solar photovoltaic systems	3			35
K/602/3088	Install, commission and handover small scale solar photovoltaic systems	3			15
M/602/3089	Know the requirements to inspect, service and maintain small scale solar photovoltaic systems	3			15
M/602/3092	Inspect, service and maintain small scale solar photovoltaic systems	3			15
<b>Totals</b>			<b>10</b>	<b>100</b>	<b>80</b>

### Note

Total Qualification Time (TQT) is comprised of the following two elements:

(a) the number of hours which an awarding organisation has assigned to a qualification for Guided Learning, and

(b) an estimate of the number of hours a Learner will reasonably be likely to spend in preparation, study or any other form of participation in education or training, including assessment, which takes place as directed by – but, unlike Guided Learning, not under the Immediate Guidance or Supervision of – a lecturer, supervisor, tutor or other appropriate provider of education or training.

## Unit Details

The next pages detail the requirements of the 4 individual Units that make up this Award:

<b>Unit Ref</b>	<b>Unit Title</b>	<b>Page</b>
D/602/3086	Know the requirements to install, commission and handover small scale solar photovoltaic systems	5
K/602/3088	Install, commission and handover small scale solar photovoltaic systems	12
M/602/3089	Know the requirements to inspect, service and maintain small scale solar photovoltaic systems	15
M/602/3092	Inspect, service and maintain small scale solar photovoltaic systems	17

## **D/602/3086 - Know the requirements to install, commission and handover small scale solar photovoltaic systems**

The unit focuses upon the knowledge required to plan and prepare for, install (including testing and commissioning) and handover of grid connected solar photovoltaic systems that are within the scope of Engineering Recommendation G83/1 with an electrical output of up to 5 kilowatt peak (kWp) connected to both single and three-phase installations. The unit also includes fundamental design awareness and component selection outcomes but does not include detailed design.

### ***Please note:***

*Whilst a number of the learning outcomes within this unit will have some relevance to larger scale solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1, achievement of the learning outcomes will not provide the full underpinning knowledge required to plan, install and handover solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1.*

- Know the health and safety risks and safe systems of work associated with solar photovoltaic system installation work
- Know the requirements of the relevant regulations/ standards relating to practical installation, testing and commissioning activities for solar photovoltaic system installation work
- Know the fundamental differences between a.c and d.c circuits within solar photovoltaic systems
- Know the purpose of solar photovoltaic system components
- Know the types, silicon characteristics and typical conversion efficiencies of solar photovoltaic modules
- Know the fundamental design principles used to determine solar photovoltaic system module array size and position requirements
- Know the preparatory work required for solar photovoltaic system installation work
- Know the layouts and the requirements for installing solar photovoltaic module arrays
- Know solar photovoltaic system d.c and a.c circuit installation layouts within the scope of the relevant Engineering Recommendation for grid tied systems
- Know solar photovoltaic system protection techniques and components
- Know the requirements to test and commission solar photovoltaic systems
- Know the requirements to handover solar photovoltaic systems

<b>Learning Outcome 1</b>												
1. Know the health and safety risks and safe systems of work associated with solar photovoltaic system installation work												
<b>Assessment Criteria</b>												
<p>1.1 Confirm which aspects of solar photovoltaic system installation work pose risk of:</p> <table border="0"> <tr> <td>a. electrocution/electric shock</td> <td>d. personal injury though component / equipment handling</td> </tr> <tr> <td>b. burns</td> <td></td> </tr> <tr> <td>c. a fall from height</td> <td></td> </tr> </table> <p>1.2 Confirm safe systems of work for solar photovoltaic system installation work in relation to prevention of:</p> <table border="0"> <tr> <td>a. electrocution/electric shock</td> <td>d. personal injury though component / equipment handling</td> </tr> <tr> <td>b. burns</td> <td></td> </tr> <tr> <td>c. a fall from height</td> <td></td> </tr> </table>	a. electrocution/electric shock	d. personal injury though component / equipment handling	b. burns		c. a fall from height		a. electrocution/electric shock	d. personal injury though component / equipment handling	b. burns		c. a fall from height	
a. electrocution/electric shock	d. personal injury though component / equipment handling											
b. burns												
c. a fall from height												
a. electrocution/electric shock	d. personal injury though component / equipment handling											
b. burns												
c. a fall from height												

<b>Learning Outcome 2</b>																
2. Know the requirements of the relevant regulations/ standards relating to practical installation, testing and commissioning activities for solar photovoltaic system installation work																
<b>Assessment Criteria</b>																
<p>2.1 Interpret building regulation/building standards guidance as relevant to solar photovoltaic system installation work in relation to:</p> <table border="0"> <tr> <td>a. maintaining the structural integrity of the building</td> <td>d. notification of works</td> </tr> <tr> <td>b. mandating the fire resistant integrity of the building</td> <td>e. electrical safety</td> </tr> <tr> <td>c. the prevention of moisture ingress (building water tightness)</td> <td>f. system installation</td> </tr> <tr> <td></td> <td>g. energy conservation</td> </tr> <tr> <td></td> <td>h. inspections and testing</td> </tr> <tr> <td></td> <td>i. commissioning</td> </tr> </table> <p>2.2 Interpret industry recognised electrical wiring regulation requirements as relevant to solar photovoltaic system installation work in relation to:</p> <table border="0"> <tr> <td>a. system installation</td> <td>c. commissioning</td> </tr> <tr> <td>b. inspection and testing</td> <td></td> </tr> </table>	a. maintaining the structural integrity of the building	d. notification of works	b. mandating the fire resistant integrity of the building	e. electrical safety	c. the prevention of moisture ingress (building water tightness)	f. system installation		g. energy conservation		h. inspections and testing		i. commissioning	a. system installation	c. commissioning	b. inspection and testing	
a. maintaining the structural integrity of the building	d. notification of works															
b. mandating the fire resistant integrity of the building	e. electrical safety															
c. the prevention of moisture ingress (building water tightness)	f. system installation															
	g. energy conservation															
	h. inspections and testing															
	i. commissioning															
a. system installation	c. commissioning															
b. inspection and testing																

<b>Learning Outcome 3</b>	
3. Know the fundamental differences between a.c and d.c circuits within solar photovoltaic systems	
<b>Assessment Criteria</b>	
3.1 Confirm the fundamental differences between a.c and d.c circuits within solar photovoltaic systems in relation to:	
a. voltages	c. selection of appropriate system components
b. safe isolation	

<b>Learning Outcome 4</b>	
4. Know the purpose of solar photovoltaic system components	
<b>Assessment Criteria</b>	
4.1 Confirm the purpose of the following solar photovoltaic system components:	
a. photovoltaic module	h. d.c junction box
b. module mounting systems	i. Inverter
c. d.c. cabling	j. a.c isolators
d. PV connectors	k. a.c. distribution board
e. blocking diodes	l. generation meter
f. d.c. isolator	m. generation display unit
g. d.c. fuses	n. labels

<b>Learning Outcome 5</b>	
5. Know the types, silicon characteristics and typical conversion efficiencies of solar photovoltaic modules	
<b>Assessment Criteria</b>	
5.1 Identify the following types of solar photovoltaic module:	
a. 'On roof' photovoltaic module	c. 'In roof' (slate) photovoltaic module
b. thin film photovoltaic module	d. 'In roof' (tile) photovoltaic module
- silicon-based	e. building integrated photovoltaic module
- non-silicon based	
5.2 Confirm the silicon characteristics of:	
a. monocrystalline photovoltaic modules	c. thin film photovoltaic modules
b. polycrystalline/multicrystalline photovoltaic modules	
5.3 State the relevant manufacturing compliance requirements for:	
a. crystalline type modules	b. thin film type modules

<b>Learning Outcome 5</b>
5. Know the types, silicon characteristics and typical conversion efficiencies of solar photovoltaic modules (Continued)
<b>Assessment Criteria</b>
5.4 State the typical conversion efficiencies associated with: <ul style="list-style-type: none"> <li>a. monocrystalline photovoltaic modules</li> <li>b. polycrystalline/multicrystalline photovoltaic modules</li> <li>c. thin film photovoltaic modules</li> </ul>

<b>Learning Outcome 6</b>
6. Know the fundamental design principles used to determine solar photovoltaic system module array size and position requirements
<b>Assessment Criteria</b>
6.1 Confirm the information required to enable solar photovoltaic array design in relation to: <ul style="list-style-type: none"> <li>a. building design</li> <li>b. building dimensions/angles</li> <li>c. building location and orientation</li> <li>d. building fabric/material details</li> </ul>
6.2 Confirm how to calculate the nominal power (kWp) per m <sup>2</sup> of a given product
6.3 Confirm how annual solar photovoltaic electrical output (kWh) can be affected by: <ul style="list-style-type: none"> <li>a. geographical irradiation levels</li> <li>b. the array mounting angle</li> <li>c. the array orientation</li> <li>d. over shading of the array or modules within the array</li> </ul>
6.4 Confirm the potential effect of shading on: <ul style="list-style-type: none"> <li>a. solar photovoltaic module condition</li> <li>b. solar photovoltaic array condition</li> </ul>
6.5 Identify the potential benefit(s) of incorporating a solar tracker into the system design

<b>Learning Outcome 7</b>
7. Know the preparatory work required for solar photovoltaic system installation work
<b>Assessment Criteria</b>
7.1 Confirm the requirements of pre-installation checks in relation to: <ul style="list-style-type: none"> <li>a. authorisation for the work to proceed</li> <li>b. the availability of appropriate access to all required work areas</li> <li>c. the inspection and testing of existing electrical installations</li> <li>d. the proposed siting of key internal system components</li> <li>e. the suitability of the building structure in relation to the proposed installation</li> <li>f. the suitability of the proposed location and position of the PV modules for optimum collection capacity</li> <li>g. the suitability of the building fabric in relation to the installation of the PV modules</li> </ul>



## Learning Outcome 8

8. Know the layouts and the requirements for installing solar photovoltaic module arrays

### Assessment Criteria

- 8.1 Recognise the following solar photovoltaic system module array layouts:
- a. single array, single string
  - b. single array, multiple string
- 8.2 Confirm the requirements for handling, moving and storing solar photovoltaic modules
- 8.3 Confirm the requirements for fixing 'on roof' solar photovoltaic modules to pitched roof slopes
- 8.4 Confirm the requirements for fixing 'in roof' solar photovoltaic modules to pitched roof slopes
- 8.5 Confirm the requirements for fixing solar photovoltaic modules using secondary frame structures
- 8.6 Confirm the requirements for ventilation in relation solar photovoltaic modules/module arrays
- 8.7 Confirm how to achieve durable weather-tightness of buildings where array cables pass through the building fabric
- 8.8 State 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 Confirm the requirements for connecting solar photovoltaic modules in a single string array
- 8.10 Confirm 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:
- a. inverter rating
  - b. overall system installation
- 8.12 Confirm the requirements for cable routing within solar photovoltaic module arrays in relation to:
- a. avoidance of inductive loops
  - b. other requirements
- 8.13 Propose the correct sequence of work to minimise the risk of injury through electrocution

<b>Learning Outcome 9</b>
9. Know solar photovoltaic system d.c and a.c circuit installation layouts within the scope of the relevant Engineering Recommendation for grid tied systems
<b>Assessment Criteria</b>
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

<b>Learning Outcome 10</b>				
10. Know solar photovoltaic system protection techniques and components				
<b>Assessment Criteria</b>				
10.1 Confirm the techniques and components used to protect system and or/building users in relation to: <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">a. d.c. circuit over and under voltage protection</td> <td style="width: 50%;">b. d.c. circuit over and under current protection</td> </tr> </table>	a. d.c. circuit over and under voltage protection	b. d.c. circuit over and under current protection		
a. d.c. circuit over and under voltage protection	b. 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: <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">a. a.c. circuit over and under voltage protection</td> <td style="width: 50%;">c. a.c. circuit over and under current protection</td> </tr> <tr> <td style="width: 50%;">b. a.c. circuit over and under frequency protection</td> <td></td> </tr> </table>	a. a.c. circuit over and under voltage protection	c. a.c. circuit over and under current protection	b. a.c. circuit over and under frequency protection	
a. a.c. circuit over and under voltage protection	c. a.c. circuit over and under current protection			
b. a.c. circuit over and under frequency protection				

<b>Learning Outcome 11</b>						
11. Know the requirements to test and commission solar photovoltaic systems						
<b>Assessment Criteria</b>						
11.1 Confirm the pre-commissioning procedures and/or requirements for a solar photovoltaic system in relation to: <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">a. compliance with relevant installation instructions/regulatory requirements</td> <td style="width: 50%;">d. the provision of adequate ventilation for system components</td> </tr> <tr> <td style="width: 50%;">b. compliance with the system design</td> <td style="width: 50%;">e. electrical safety</td> </tr> <tr> <td style="width: 50%;">c. the security and integrity of system components</td> <td style="width: 50%;">f. electrical over-current protection arrangements</td> </tr> </table>	a. compliance with relevant installation instructions/regulatory requirements	d. the provision of adequate ventilation for system components	b. compliance with the system design	e. electrical safety	c. the security and integrity of system components	f. electrical over-current protection arrangements
a. compliance with relevant installation instructions/regulatory requirements	d. the provision of adequate ventilation for system components					
b. compliance with the system design	e. electrical safety					
c. the security and integrity of system components	f. 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						

<b>Learning Outcome 11</b>
11. Know the requirements to test and commission solar photovoltaic systems (continued)
<b>Assessment Criteria</b>
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

<b>Learning Outcome 12</b>
12. Know the requirements to handover solar photovoltaic systems
<b>Assessment Criteria</b>
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: a. provision of written information                      c. provision of verbal information / b. provision of diagrammatic                              demonstration relating to system information    operation and use

## K/602/3088 - Install, commission and handover small scale solar photovoltaic systems

The unit focuses upon the occupational competence required to plan and prepare for, install (including testing and commissioning) and handover of grid connected solar photovoltaic systems that are within the scope of Engineering Recommendation G83/1 with an electrical output of up to 5 kilowatt peak (kWp) connected to both single and three-phase installations.

### **Please note:**

*Whilst a number of the learning outcomes within this unit will have some relevance to larger scale solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1, achievement of the learning outcomes will not provide the full occupational competence required to plan, install and handover solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1.*

- Plan and prepare for the installation of a solar photovoltaic system
- Install solar photovoltaic system components
- Inspect and test a new solar photovoltaic system installation
- Commission a new solar photovoltaic system installation
- Handover a new solar photovoltaic system installation

Learning Outcome 1								
1. Plan and prepare for the installation of a solar photovoltaic system								
Assessment Criteria								
<p>1.1 Undertake pre-installation checks in relation to:</p> <table border="0"> <tr> <td>a. authorisation for the work to proceed</td> <td>e. the suitability of the building structure in relation to the proposed installation</td> </tr> <tr> <td>b. the availability of appropriate access to all required work areas</td> <td>f. the suitability of proposed location of the PV modules for optimum collection capacity</td> </tr> <tr> <td>c. the inspection of existing electrical installations</td> <td>g. the suitability of the building fabric in relation to the installation of the PV modules</td> </tr> <tr> <td>d. the proposed siting of key internal system components</td> <td></td> </tr> </table> <p>1.2 Confirm that the tools, materials and equipment required for the installation work are available and are in a safe usable condition</p>	a. authorisation for the work to proceed	e. the suitability of the building structure in relation to the proposed installation	b. the availability of appropriate access to all required work areas	f. the suitability of proposed location of the PV modules for optimum collection capacity	c. the inspection of existing electrical installations	g. the suitability of the building fabric in relation to the installation of the PV modules	d. the proposed siting of key internal system components	
a. authorisation for the work to proceed	e. the suitability of the building structure in relation to the proposed installation							
b. the availability of appropriate access to all required work areas	f. the suitability of proposed location of the PV modules for optimum collection capacity							
c. the inspection of existing electrical installations	g. the suitability of the building fabric in relation to the installation of the PV modules							
d. the proposed siting of key internal system components								

<b>Learning Outcome 2</b>
2. Install solar photovoltaic system components
<b>Assessment Criteria</b>
2.1 Install a solar photovoltaic array in accordance with: a. manufacturer's guidance                      c. industry recognised procedures b. regulatory requirements  to include 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 the positioning, fixing and connection of the following components: a. d.c. isolator                                      c. d.c. cabling from module(s) to d.c. isolator b. inverter    d. d.c. cabling from d.c. isolator to inverter

<b>Learning Outcome 3</b>
3. Inspect and test a new solar photovoltaic system installation
<b>Assessment Criteria</b>
3.1 Inspect and test the a.c. circuit in accordance with the design specification, manufacturer's requirements and the relevant regulatory requirements
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

<b>Learning Outcome 4</b>
4. Commission a new solar photovoltaic system installation
<b>Assessment Criteria</b>
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 5**

5. Handover a new solar photovoltaic system installation

#### **Assessment Criteria**

- 5.1 Undertake relevant checks to ensure that the system is ready for handover and compliant with manufacturer's guidance, regulatory requirements and industry recognised requirements
- 5.2 Explain and demonstrate to the end user the operation and use of the system using manufacturer's guidance and industry agreed handover procedures
- 5.3 Identify and explain to the end user any aspects of the system that varies from the agreed specifications and requirements
- 5.4 Obtain acceptance by the end user of the system according to the industry agreed handover procedures
- 5.5 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

## M/602/3089 - Know the requirements to inspect, service and maintain small scale solar photovoltaic systems

The unit focuses upon the knowledge required to inspect, service and maintain (including fault diagnosis and rectification) solar photovoltaic systems. The unit focuses upon grid connected systems that are within the scope of Engineering Recommendation G83/1 with an electrical output of up to 5 kilowatt peak (kWp) connected to both single and three-phase installations.

### **Please note:**

*Whilst a number of the learning outcomes within this unit will have some relevance to larger scale solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1, achievement of the learning outcomes will not provide the full underpinning knowledge required to inspect, service and maintain solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1.*

- Know the requirements for the routine inspection, service and maintenance of solar photovoltaic system installations
- Know how to diagnose faults in solar photovoltaic system installations
- Know how to rectify faults in solar photovoltaic systems

Learning Outcome 1						
1. Know the requirements for the routine inspection, service and maintenance of solar photovoltaic system installations						
Assessment Criteria						
1.1 State which documentation needs to be available to enable a routine service and maintenance inspection						
1.2 Confirm the typical routine service and maintenance requirements in relation to: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">a. visual inspection requirements</td> <td style="width: 50%;">d. functional testing</td> </tr> <tr> <td>b. cleaning of components</td> <td>e. performance testing</td> </tr> <tr> <td>c. safe condition testing</td> <td>f. adjustment of controls/components</td> </tr> </table>	a. visual inspection requirements	d. functional testing	b. cleaning of components	e. performance testing	c. safe condition testing	f. adjustment of controls/components
a. visual inspection requirements	d. functional testing					
b. cleaning of components	e. performance testing					
c. safe condition testing	f. adjustment of controls/components					
1.3 Confirm the recording and reporting requirements for routine maintenance work						

Learning Outcome 2						
2. Know how to diagnose faults in solar photovoltaic system installations						
Assessment Criteria						
2.1 State the information that needs to be available to enable fault diagnosis						
2.2 Confirm the work action and sequences required to diagnose the following faults: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">a. loss of full collection capacity</td> <td style="width: 50%;">d. no output from d.c. circuit</td> </tr> <tr> <td>b. loss of output from inverter</td> <td>e. broken or damaged solar module</td> </tr> <tr> <td>c. loss of a.c. supply circuit to inverter</td> <td>f. cable failure within d.c. circuit</td> </tr> </table>	a. loss of full collection capacity	d. no output from d.c. circuit	b. loss of output from inverter	e. broken or damaged solar module	c. loss of a.c. supply circuit to inverter	f. cable failure within d.c. circuit
a. loss of full collection capacity	d. no output from d.c. circuit					
b. loss of output from inverter	e. broken or damaged solar module					
c. loss of a.c. supply circuit to inverter	f. cable failure within d.c. circuit					

**Learning Outcome 3**

3. Know how to rectify faults in solar photovoltaic systems

**Assessment Criteria**

3.1 Confirm the work action and sequences required to rectify the following faults:

- |  |                                      |
|--|--------------------------------------|
| a. loss of full collection capacity        | d. no output from d.c. circuit       |
| b. loss of output from inverter            | e. broken or damaged solar module    |
| c. loss of a.c. supply circuit to inverter | f. cable failure within d.c. circuit |



## M/602/3092 - Inspect, service and maintain small scale solar photovoltaic systems

The unit focuses upon the occupational competence required to inspect, service and maintain (including fault diagnosis and rectification) solar photovoltaic systems. The unit focuses upon grid connected systems that are within the scope of Engineering Recommendation G83/1 with an electrical output of up to 5 kilowatt peak (kWp) connected to both single and three-phase installations.

### **Please note:**

*Whilst a number of the learning outcomes within this unit will have some relevance to larger scale solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1, achievement of the learning outcomes will not provide the full occupational competence required to plan, install and handover solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1.*

- Undertake the routine service and maintenance of a solar photovoltaic system installation
- Undertake fault diagnosis work on a solar photovoltaic system installations
- Undertake fault rectification work on solar photovoltaic system installations

Learning Outcome 1	
1. Undertake the routine service and maintenance of a solar photovoltaic system installation	
Assessment Criteria	
1.1 Obtain the relevant information required to enable the work	
1.2 Undertake, using safe systems of work, a visual service and maintenance inspection to include checks in relation to:	
a. compliance with manufacturer's installation instructions	e. the security of fixing of system components
b. compliance with statutory regulations	f. the provision of adequate ventilation of system components
c. the condition of system components	
d. the correct positioning of system components	
1.3 Undertake using safe systems of work, routine servicing of relevant system components to include:	
a. cleaning of systems components	b. checking/adjustment of system controls
1.4 Undertake, using safe systems of work, routine service and maintenance tests to include:	
a. tests required under statutory regulations	c. tests to confirm the correct operation of system controls
b. tests to confirm the correct operation of system safety devices	d. checks/actions to confirm the optimum performance of the PV array(s)

<b>Learning Outcome 2</b>
2. Undertake fault diagnosis work on a solar photovoltaic system installations
<b>Assessment Criteria</b>
2.1 Obtain the relevant information required to enable the work
2.2 Identify using safe systems of work, the cause of a minimum of FOUR separate faults from the following list: a. loss of full collection capacity b. loss of output from inverter c. loss of a.c. supply circuit to inverter d. no output from d.c. circuit e. broken or damaged solar PV module f. cable failure within d.c. circuit
2.3 Agree with the relevant person(s) fault rectification procedures for the faults identified

<b>Learning Outcome 3</b>
3. Undertake fault rectification work on solar photovoltaic system installations
<b>Assessment Criteria</b>
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: a. loss of full collection capacity b. loss of output from inverter c. loss of a.c. supply circuit to inverter d. no output from d.c. circuit e. broken or damaged solar PV module f. 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

## Assessment of Requirements for Individual Units

### Unit Ref: K/602/3138 Understand the Fundamental Principles and Requirements of Environmental Technology Systems BPEC EVTSPV-01

To achieve the completion of this **knowledge unit**, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit (detail contained with BPEC assessment specification).

### Unit Ref: D/602/3086 Know the requirements to install, commission and handover small scale solar photovoltaic systems BPEC EVTSPV-02

To achieve the completion of this **knowledge unit**, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit (detail contained with BPEC assessment specification).

### Unit Ref: K/602/3088 Install, commission and handover small scale solar photovoltaic systems BPEC EVTSPV-03

To achieve the completion of this **performance unit** you must:

- complete the appropriate practical performance activities in simulated conditions as per the requirements for unit EVTSPV-03 as specified in the BPEC Practical Assessment manual for this qualification.

**Or**

- provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment.

### Unit Ref: M/602/3089 Know the requirements to inspect, service and maintain small scale solar photovoltaic systems BPEC EVTSPV-04

To achieve the completion of this **knowledge unit**, you must satisfactorily complete the applicable knowledge assessment for the knowledge learning outcomes within the unit (detail contained with BPEC assessment specification/Practical Assessment manual).

### Unit Ref: M/602/3092 Inspect, service and maintain small scale solar photovoltaic systems BPEC EVTSPV-05

To achieve the completion of this **performance unit** you must:

- complete the appropriate practical performance activities in simulated conditions as per the requirements for unit EVTSPV-03 as specified in the BPEC Practical Assessment manual for this qualification.

**Or**

- provide satisfactory evidence of having met the requirements of the Learning Outcomes and Assessment Criteria from a real working environment

## SummitSkills Assessment Strategy for Building Services Engineering (Knowledge and Performance requirements)

Knowledge unit/Knowledge Learning Outcome assessment requirements	
3.5	<p>The assessment instruments for <b>Knowledge Units</b> must be as identified in the “Additional Information” of the unit, be fit-for-purpose and be one or more of;</p> <p>3.5.1 Knowledge tests - centrally set, centrally marked and quality assured by the Awarding Organisations who offer a unit(s) or qualification(s) identified in this strategy.</p> <p>3.5.2 Knowledge based projects or assignments that are centrally set, centre marked and quality assured by the Awarding Organisations who offer a unit(s) or qualification(s) identified in this strategy.</p> <p>3.5.3 Knowledge based professional discussion that is centre devised following centrally specified guidance, centre marked and quality assured by the Awarding Organisations who offer a unit(s) or qualification(s) identified in this strategy.</p>
Performance unit/Performance Learning Outcome assessment requirements (simulated)	
3.6	<p>The environment in which the evidence and the quantity of evidence for <b>Performance Units</b> must be assessed, i.e. sourced from the real working environment or simulated conditions, will be detailed in the “Additional Requirements” for each Performance Unit. This could be applicable to all the Learning Outcomes in the unit or particular Learning Outcomes.</p>
Performance unit/Performance Learning Outcome assessment requirements (real working environment)	
3.7	<p>Evidence that is sourced from the real working environment for <b>Performance Units</b> must be naturally occurring and can be generated by;</p> <p>3.7.1 Direct observation of performance in the workplace by a qualified assessor and/or testimony from an expert witness subject to the activity being assessed (Also see 3.6 above). This will be the primary source of evidence.</p> <p>3.7.2 Candidate’s reflective account of performance. (Write up of work completed)</p> <p>3.7.3 Work plans and work based products e.g. diagrams, drawings, specifications, customer testimony, authorised &amp; authenticated photographs/ images an audiovisual records of work completed.</p> <p>3.7.4 Evidence from prior achievements that demonstrably match the requirements of the Performance Unit.</p> <p>3.7.5 Witness testimony</p>

## Scheme Documentation

The following documentation will also be supplied by BPEC Certification Ltd. to support the delivery of the L3 Award in the Installation and Maintenance of Small Scale Solar Photovoltaic Systems.

- Combined qualification assessment manual, including:
  - Assessment documentation
    - In centre practical performance assessment guidance
    - In centre practical performance assessment material
    - On the job workplace performance assessment guidance
    - On the job workplace performance guidance material
- Knowledge assessment papers and question specifications (*centre only*)
- Off the job performance training guidance
- Portfolio building guidance
- On site assessment guidance
- Delivery support materials
  - Scheme of work and sample lesson plans
  - Full training manual
  - Supporting Powerpoint presentations
  - Links to manufacturer's and other useful sources of information
- Sample teaching file including exemplar tracking documentation

## Assessment Documentation

### Simulated Performance Assessments

For all 'Performance units' where evidence is not being provided from site, learners will be required to successfully complete a number of different performance assessments. All appropriate information and supporting documentation is contained within the BPEC Performance assessment manual for the qualification which applies to the following units:

- Install, commission and handover small scale solar photovoltaic systems
- Inspect, service and maintain small scale solar photovoltaic systems
- Know the requirements to inspect, service and maintain small scale solar photovoltaic systems

### Marking Simulated Performance Assessments

The pass rate for the performance assessments is 100%

1. First Attempt - learners are given a first attempt in all areas of the performance assessment
2. Second Attempt – performance areas not satisfactorily completed will be re-attempted
3. At the assessors discretion, the learner is re-assessed by oral questioning and/or observing the performance in an attempt to establish competence in all remaining areas
4. Learners who have not achieved the 100% pass mark at this stage will be deemed to have failed the performance assessment. Learners wishing to retake the assessment will be required to re-attempt the full performance assessment in its entirety

## Knowledge and Understanding Assessments

The units listed below all require the learner to complete a unit knowledge assessment. The knowledge assessments (and supporting rationale) are provided by BPEC Certification Ltd.

- Know the requirements to install, commission and handover small scale solar photovoltaic systems

## Marking Knowledge Assessments

The pass rate for the On-line knowledge assessments is 60%

## Learner Result Form

A Learner Result Form has been produced for the L3 Award in the Installation and Maintenance of Small Scale Solar Photovoltaic Systems. This document shall be used to record that the learner has completed the whole qualification in a satisfactory manner. The document shall be completed and signed by the centre assessor and the internal verifier.

The completed Learner Result Form shall be sent to BPEC Certification Ltd. (with attached passport photo) for certification. Copies of the Learner Result Form shall also be retained in the Learner Portfolio and the Centre Portfolio.

## Evidence Forms

BPEC Certification Ltd. has designed evidence forms which may be used to capture evidence relating to a learners performance in the workplace or in simulated workplace environments. Such evidence may include:

- Assessor feedback to the learner
- Records of supplementary questions posed by the assessor and the learner responses
- Learner feedback – statements made by the learner to clarify their competence
- Witness testimony – statements made by witnesses e.g. supervisor, customer etc. relating to the competence of the learner

These evidence forms are contained in the Qualification Assessment Manual and have been designed so that they can be copied/reprinted as many times as is required.

## Portfolio Contents

The table below identifies the contents to be retained within the learner and the centre portfolios:

	Learner Portfolio	Centre Portfolio
<b>Learner result form</b>	✓	✓
<b>Evidence collected e.g. work records, evidence forms</b>	✓	
<b>Knowledge assessment documentation</b>		✓
<b>Performance assessment documentation (contained in qualification assessment manual)</b>	✓	✓

## Staff Qualification Requirements

### Assessors

Assessors **MUST** be vocationally and occupationally competent in the areas they are assessing and have a thorough knowledge of the National Occupational Standards and Units of Assessment.

The assessor must be able to provide appropriate documented evidence that demonstrates they have a minimum of 5 years proven occupational experience in the activities they will be assessing e.g. a signed and dated CV. This verifiable evidence must be at or above the level of competence being assessed.

### Qualifications

Assessors shall be technically qualified in Electrotechnical Installation, and must be able to provide evidence in one or more of the following ways:

- A relevant qualification (e.g. NVQ/SVQ or equivalent in Electrotechnical Installation)
- Registration with the appropriate industry registration body at the relevant occupational level and grade.

The assessor must also hold one of the following assessor qualifications:

- QCF Level 3 Award “Assessing Vocational Related Achievement – in Centres/Colleges or Training Providers” or
- QCF Level 3 Certificate “Assessing Vocationally Related Achievement – in Centres/Colleges and The Workplace” or
- A1 or D32 /D33 with an Upgrade to A1 as a minimum \*

‘Workplace Assessors’ MUST hold:

- QCF Level 3 Award “Assessing Competence in the Workplace Environment” or
- QCF Level 3 Certificate “Assessing Vocationally Related Achievement – in Centres/Colleges and The Workplace” or
- A2 or D32 with an upgrade to A2 as a minimum\*

Assessors holding D units must have evidence of Continuing Professional Development (CPD) to demonstrate compliance with the A units. Evidence of CPD will be sought by the External Verifier for all Assessors approved to assess for the centre.

‘Candidate assessors’ who are working towards their assessor qualifications must always be supervised by a qualified assessor. They should have a clear action plan for achieving the assessor qualification(s), (assessor approval will be withdrawn if the assessor qualification/units have not been attained within a period of 18 months).

### Internal Verifiers

The main focus of IV’s is with the quality assurance of assessment procedures.

The IV is required to have a minimum of occupational experience evidenced by having a Building Services Engineering sector related qualification or proven sector competence/experience plus access to relevant “occupational expertise” to enable them to conduct their role as internal verifier appropriately. This evidence and access to “occupational expertise” is quality assured by the Awarding Organisation

## Qualifications

Internal Verifiers must hold the following:

- QCF Level 3 Certificate “Assessing Vocationally Related Achievement – in Centres/Colleges and The Workplace”
- QCF Level 4 Award “ Internal Quality assurance of assessment processes and practice” or
- QCF Level 4 Certificate “leading the Internal Quality assurance of assessment processes and practice” or
- A1 or D32/D33 with an upgrade to A1 as a minimum\*
- V1 or D34 with an upgrade to V1 as a minimum\*

\*The Teaching Qualification for Secondary Education (TQSE) or the Teaching Qualification for Further Education (TQFE) (which is recognised in Scotland) these awards are acceptable providing they are the versions that are recognised as equivalents to the A1 award. Internal Verifiers holding D units must have evidence of CPD to demonstrate compliance with the A and V units.

It is recommended that ‘Candidate Internal Verifiers’ have a clear action plan for achieving the Internal Verifier qualification(s). Internal Verifier approval will be withdrawn if the qualification/units have not been attained within the approved period (18 months).

## Continuing Professional Development (CPD)

The occupational competence of assessors and internal verifiers must be updated on a regular basis and be periodically reconfirmed via continuing professional development (CPD) which is recorded by the assessment centres.



## Further Information

Requests for further information regarding centre/scheme approval or any aspect of assessment of the BPEC qualifications please contact:

BPEC Certification Ltd. 2 Mallard Way, Pride Park, Derby, DE24 8GX  
T 0845 644 6558 F 0845 121 1931 E [AOadmin@bpec.org.uk](mailto:AOadmin@bpec.org.uk) W [www.bpec.org.uk](http://www.bpec.org.uk)

### Annex 1 – Sector Skills Councils

The Sector Skills Councils have the responsibility for development of the national occupational standards and in many cases, facilitating the development of relevant sector vocational qualifications. Similarly, the Sector Skills Councils formulate the ‘assessment strategy’ for these qualifications, contact details of the relevant Sector Skills Council(s) are shown below:

SummitSkills Limited, Vega House, Opel Drive, Fox Milne, Milton Keynes, MK15 0DF  
T: 01908 303960 W: [www.summitskills.org.uk](http://www.summitskills.org.uk)