

# Qualification Guide

**BPEC 600/6608/8 - Level 3 Award in the Installation and Maintenance of Solar Thermal Hot Water Systems**



# Level 3 Award in the Installation and Maintenance of Solar Thermal Hot Water 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 Thermal). This guide details the requirements for both centres delivering the L3 Award in the Installation and Maintenance of Solar Thermal Hot Water 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 Solar Thermal Hot Water 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 and maintenance of Solar Thermal Hot Water systems.*

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## Rules of Combination

### L3 Award in the Installation and Maintenance of Solar Thermal Hot Water Systems

This is a Level 3 qualification of 10 credits and 80 guided learning hours consisting of 5 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 solar thermal hot water systems. The qualification and unit details are shown below:

<b>Qualification Title</b>	<b>L3 Award in the Installation and Maintenance of Solar Thermal Hot Water Systems</b>				
<b>BPEC Qualification Number</b>	<b>ETS - 002</b>				
<b>Last Registration Date</b>	<b>31/08/2014</b>				
<b>Last Certification Date</b>	<b>31/08/2016</b>				
<b>QCF Unit Ref</b>	<b>Unit Title</b>	<b>Level</b>	<b>Credit Value</b>	<b>Notional Learning Time</b>	<b>Guided Learning Hours</b>
F/602/3100	Know the requirements to install, commission and handover solar thermal hot water systems	3	4	35	35
L/602/3102	Install, commission and handover 'active' solar thermal hot water systems	3	2	15	15
Y/602/3104	Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems	3	2	15	15
K/602/3107	Inspect, service and maintain 'active' solar thermal hot water systems	3	2	15	15
<b>Totals</b>			<b>10</b>	<b>80</b>	<b>80</b>

## Note

Notional Learning Time (NLT) is the average time for a learner to achieve the learning outcomes and assessment criteria. An initial assessment of a learner's ability to achieve the qualification should be carried out to estimate the learning time. It can be assumed that a learner with no previous experience in the work activity will require between 20 – 25% additional learning time to complete the qualification, whereas an experienced learner may require some 20 – 25% less learning time.

Guided Learning Hours (GLH) is the estimated number of hours of teacher supervised or directed study time required to teach the qualification and each unit.

## Unit Details

The next pages detail the requirements of the 5 individual Units that make up this Award:

QCF Unit Ref	Unit Title	Page
F/602/3100	Know the requirements to install, commission and handover solar thermal hot water systems	5
L/602/3102	Install, commission and handover 'active' solar thermal hot water systems	14
Y/602/3104	Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems	17
K/602/3107	Inspect, service and maintain 'active' solar thermal hot water systems	19

## **F/602/3100 - Know the requirements to install, commission and handover solar thermal hot water systems**

The unit focuses upon the knowledge required to plan and prepare for, install (including testing and commissioning) and handover of fully-filled and drainback solar thermal hot water systems. The emphasis is upon 'active' systems but the unit also includes some content relating to 'passive' systems. The unit also covers fundamental design techniques but does not cover detailed design. The unit covers systems for domestic hot water production only. The unit focuses upon systems with up to 20m<sup>2</sup> of solar collector area. Upon completion of the unit the learner will:

- Know the health and safety risks and safe systems of work associated with solar thermal hot water system installation work
- Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for solar thermal hot water system installation work
- Know the types and layouts of solar thermal hot water system
- Know the purpose of components used within solar thermal hot water system installations
- Know the types and key operating principles of solar collectors
- Know the information requirements to enable system component selection and sizing
- Know the fundamental techniques used to select, size and position components for solar thermal hot water systems
- Know how the performance of solar hot water systems is measured
- Know the preparatory work required for solar thermal hot water system installation work
- Know the requirements for connecting solar thermal hot water system collector circuits to combination boiler domestic hot water circuits
- Know the requirements for installing solar collector arrays
- Know the requirements for installing for solar thermal hot water system pipework
- Know the requirements to test and commission solar thermal hot water system installations
- Know the requirements to handover solar thermal hot water systems

<b>Learning Outcome 1</b>	
1. Know the health and safety risks and safe systems of work associated with solar thermal hot water system installation work	
<b>Assessment Criteria</b>	
1.1 Confirm which aspects of solar thermal hot water system installation work pose risk of:	
<ul style="list-style-type: none"> <li>a. electrocution/electric shock</li> <li>b. burns</li> <li>c. toxic poisoning</li> </ul>	<ul style="list-style-type: none"> <li>d. injury through flash to steam of system heat transfer fluid</li> <li>e. a fall from height</li> <li>f. personal injury through component / equipment handling</li> </ul>
1.2 Confirm safe systems of work for solar thermal hot water system installation work in relation to prevention of:	
<ul style="list-style-type: none"> <li>a. electrocution/electric shock</li> <li>b. burns</li> <li>c. toxic poisoning</li> <li>d. injury through flash to steam of system heat transfer fluid</li> </ul>	<ul style="list-style-type: none"> <li>d. a fall from height</li> <li>e. personal injury through component/equipment handling</li> </ul>

<b>Learning Outcome 2</b>	
2. Know the requirements of relevant regulations/standards relating to practical installation, testing and commissioning activities for solar thermal hot water system installation work	
<b>Assessment Criteria</b>	
2.1 Interpret building regulation/building standards guidance documentation as relevant to solar thermal hot water system installation work to identify the requirements in relation to:	
<ul style="list-style-type: none"> <li>a. maintaining the structural integrity of the building</li> <li>b. mandating the fire resistant integrity of the building</li> <li>c. the prevention of moisture ingress (building water tightness)</li> </ul>	<ul style="list-style-type: none"> <li>d. notification of work requirements</li> <li>e. control of temperature in primary and secondary circuits including primary circuits connected to unvented hot water storage systems</li> <li>f. energy conservation</li> <li>g. testing and commissioning requirements</li> <li>h. compliance certification</li> </ul>
2.2 Interpret industry recognised water regulation/byelaw guidance documentation as relevant to solar thermal hot water system installation work to identify the requirements in relation to:	
<ul style="list-style-type: none"> <li>a. prevention of contamination of the wholesome water supply</li> <li>b. energy conservation</li> </ul>	<ul style="list-style-type: none"> <li>c. safe operation</li> <li>d. testing and commissioning requirements</li> </ul>



<b>Learning Outcome 5</b>
5. Know the types and key operating principles of solar collectors
<b>Assessment Criteria</b>
5.1 Identify the following types of solar collector <ul style="list-style-type: none"><li>a. unglazed collector</li><li>b. flat plate glazed collector</li><li>c. roof integrated glazed collector</li><li>d. evacuated tube collector – direct flow</li><li>e. evacuated tube collector – heat pipe</li></ul>
5.2 Confirm the key operating principles for: <ul style="list-style-type: none"><li>a. flat plate collectors</li><li>b. evacuated tube collector – direct flow</li><li>c. evacuated tube collector – heat pipe</li></ul>
5.3 Identify the effect that the temperature difference between the solar primary circuit/collector temperature and the ambient temperature has on the relative efficiency of the following types of solar collector: <ul style="list-style-type: none"><li>a. unglazed collector</li><li>b. flat plate glazed collector</li><li>c. evacuated tube collector</li></ul>

<b>Learning Outcome 6</b>
6. Know the information requirements to enable system component selection and sizing
<b>Assessment Criteria</b>
6.1 Confirm the information requirements 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><li>e. existing input services</li><li>f. existing hot water/heating systems</li></ul>
6.2 Confirm the information requirements in relation to: <ul style="list-style-type: none"><li>a. building occupancy</li><li>b. required hot water usage pattern</li></ul>



## Learning Outcome 7

7. Know the fundamental techniques used to select, size and position components for solar thermal hot water systems

### Assessment Criteria

- 7.1 Confirm how to determine typical domestic hot water system storage vessel requirements in relation to:
- |  |   |
|--|---|
| a. daily demand (Vd) (litres/day per person or litres/day per m <sup>2</sup> of floor area)  | d. total cylinder volume (Vt)   |
| b. boiler volume (Vb)  | e. solar heat exchange coil surface area (m <sup>2</sup> of surface area in relation to collector flow rate and collector surface area) |
| c. dedicated solar volume (Vs) (litres per m <sup>2</sup> of collector area or as a % of Vd) |   |
- 7.2 Confirm how to determine typical domestic hot water system collector area requirements in relation to:
- |   |   |
|---|---|
| a. building occupancy                       | c. proposed orientation of collector installation |
| b. proposed angle of collector installation | d. Shading that may affect collector performance  |
- 7.3 Confirm how to determine the annual irradiation yield as a % of optimum in relation to:
- |                          |                           |
|--------------------------|---------------------------|
| a. collector orientation | c. collector over shading |
| b. collector angle       |                           |
- 7.4 State typical recommended solar primary circuit circulation rates
- 7.5 Confirm how to determine solar primary circuit pipe size requirements in relation to:
- |                                      |                                    |
|--------------------------------------|------------------------------------|
| a. primary circuit circulation rates | c. primary circuit pipework length |
| b. collector area                    |                                    |
- 7.6 Confirm how to determine total solar primary circuit water content volume
- 7.7 Confirm how to determine total solar primary circuit expansion vessel size requirements in relation to:
- |   |                                    |
|---|------------------------------------|
| a. primary circuit water content volume | b. collector height above cylinder |
|---|------------------------------------|
- 7.8 Identify typical sizing requirements for drainback vessels in relation to:
- |                       |                               |
|-----------------------|-------------------------------|
| a. net collector area | b. total volume of the system |
|-----------------------|-------------------------------|
- 7.9 Confirm how to determine solar primary circuit dynamic pressure drop and circulating pump size requirements for:
- |                         |                      |
|-------------------------|----------------------|
| a. fully filled systems | b. drainback systems |
|-------------------------|----------------------|

<b>Learning Outcome 8</b>
8. Know how the performance of solar hot water systems is measured
<b>Assessment Criteria</b>
8.1 Define the meaning of the term 'solar fraction'
8.2 Identify factors that affect the solar fraction

<b>Learning Outcome 9</b>
9. Know the preparatory work required for solar thermal hot water system installation work
<b>Assessment Criteria</b>
9.1 State the requirements 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> </ul>
9.2 Confirm the requirements of pre-installation checks in relation to: <ul style="list-style-type: none"> <li>a. the suitability of the proposed location and position of the solar collector(s) for optimum collection capacity</li> <li>b. the suitability of the building structure and the building fabric in relation to the installation of system components</li> <li>c. verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system energy load and usage</li> <li>d. the inspection of existing hot water/heating system installations</li> <li>e. water quality</li> <li>f. the availability of a suitable electrical input service</li> <li>g. the proposed siting of key internal system components</li> </ul>

<b>Learning Outcome 10</b>
10. Know the requirements for connecting solar thermal hot water system collector circuits to combination boiler domestic hot water circuits
<b>Assessment Criteria</b>
10.1 Confirm how to determine the suitability of combination boilers to receive preheated water
10.2 Confirm the pipework layout and components required for connecting a solar thermal hot water system to a combination boiler to include the: <ul style="list-style-type: none"> <li>a. arrangements for prevention of backflow</li> <li>b. arrangements for ensuring that the combination boiler cold inlet supply water is provided at an appropriate temperature</li> <li>c. arrangements for allowing stored hot water to be used directly from the store when the temperature of the stored water is appropriate</li> </ul>

<b>Learning Outcome 11</b>	
11. Know the requirements for installing solar collector arrays	
<b>Assessment Criteria</b>	
11.1 Confirm the positioning and fixing requirements and where appropriate the weathering requirements for the following solar collector types:	
a. flat plate, surface mounted, inclined roof with single lap roof covering	e. evacuated tube, inclined single lap roof covering
b. flat plate, surface mounted, inclined roof with double lap roof covering	f. evacuated tube, inclined double lap roof covering
c. flat plate, integrated, inclined single lap roof covering	g. frame mounted, inclined (roof, wall or ground)
d. flat plate, integrated, inclined double lap roof covering	h. frame mounted, horizontal (roof or ground)
11.2 Confirm the pipework layout, component requirements and component positioning requirements for the following system types and collector array connection arrangements:	
a. fully filled system, collector array connected in series	c. fully filled system, collector array connected with east/west split
b. fully filled system, collector array connected in parallel	d. drainback system, single collector array
11.3 Confirm the requirements to achieve durable weather-tightness of buildings where collector array connection pipework passes through the building fabric	
11.4 State when specialist equipment is required in relation to preventing irradiation reaching collector absorbers during installation	

<b>Learning Outcome 12</b>	
12. Know the requirements for installing for solar thermal hot water system pipework	
<b>Assessment Criteria</b>	
12.1 Propose suitable pipework materials in relation to:	
a. system operating temperatures	c. system chemicals
b. system operating pressures	
12.2 Confirm the requirements for pipework supports in relation to:	
a. suitable materials	b. spacing of pipework supports
12.3 State suitable pipework jointing methods in relation to:	
a. system operating temperatures	c. system chemicals
b. system operating pressures	
12.4 Confirm the requirements for pipework insulation for solar thermal hot water system installation work in relation to:	
a. system operating temperatures	e. the sections of installations that must be insulated
b. system efficiency and performance	f. the sections of installations that must not be insulated
c. potential exposure of the insulation to ultra-violet rays/light	g. resistance to vermin attack
d. potential exposure of the insulation to adverse weather	
12.5 Confirm the requirements for installing pressure relief valve discharge pipework in relation to:	
a. routing of pipework	b. termination of pipework

<b>Learning Outcome 13</b>	
13. Know the requirements to test and commission solar thermal hot water system installations	
<b>Assessment Criteria</b>	
13.1 Confirm the requirements to prepare for testing and commissioning in relation to:	
a. compliance with the system design and specification	d. flushing the system of installation debris
b. compliance with system/component manufacturer requirements	e. selection of suitable heat transfer fluid
c. suitability of electrical supply circuit arrangements	f. filling and venting the hydraulic circuits
	g. checking system water quality
	h. protection against freezing
	i. provision of system labelling
13.2 State what specialist equipment is required in relation to:	
a. the introduction and checking of system freeze protection fluids	c. checking the corrosion protection of the system
b. setting system pressure	

<b>Learning Outcome 13</b>	
13. Know the requirements to test and commission solar thermal hot water system installations (continued)	
<b>Assessment Criteria</b>	
13.3	Confirm the testing requirements for hydraulic circuits within solar thermal hot water system installations in relation to: <ul style="list-style-type: none"> <li>a. hydraulic test pressure</li> <li>b. hydraulic test duration</li> </ul>
13.4	Confirm the commissioning requirements for a fully-filled indirect sealed collector circuit installation in relation to: <ul style="list-style-type: none"> <li>a. setting of the expansion vessel charge pressure</li> <li>b. setting of the system fluid level</li> <li>c. setting of mechanical controls</li> <li>d. setting of electrical controls and temperature sensors</li> <li>e. system functional tests</li> </ul>
13.5	Confirm the commissioning requirements for a fully-filled drainback installation in relation to: <ul style="list-style-type: none"> <li>a. setting of the system fluid level</li> <li>b. setting of mechanical controls</li> <li>c. setting of electrical controls and temperature sensors</li> <li>d. system functional tests</li> </ul>
13.6	Confirm the commissioning requirements for multiple collector arrays connected in series
13.7	State the recording requirements for the commissioning of solar thermal hot water system installations

<b>Learning Outcome 14</b>	
14. Know the requirements to handover solar thermal hot water systems	
<b>Assessment Criteria</b>	
14.1	Confirm the pre-handover checks that need to be carried out
14.2	Confirm industry handover procedures in relation to the: <ul style="list-style-type: none"> <li>a. provision of written information</li> <li>b. provision of diagrammatic information</li> <li>c. provision of verbal information/demonstration relating to system operation and use</li> </ul>

## L/602/3102 - Install, commission and handover 'active' solar thermal hot water systems

The unit focuses upon the occupational competence required to plan and prepare for, install (including testing and commissioning) and handover of 'active' fully-filled and drainback solar thermal hot water systems. The unit covers systems for domestic hot water production only. The unit focuses upon systems with up to 20m<sup>2</sup> of solar collector area. Upon completion of the unit the learner will:

- Plan and prepare for the installation of 'active' solar thermal hot water system
- Install solar thermal hot water system components
- Test and commission an 'active' solar thermal hot water system
- Handover an 'active' solar thermal hot water system

Learning Outcome 1	
1. Plan and prepare for the installation of 'active' solar thermal hot water system	
Assessment Criteria	
1.1 Undertake pre-installation checks for a solar hot water system installation to include checks relating to:	
<ul style="list-style-type: none"> <li>a. authorisation for the work to proceed</li> <li>b. verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system load</li> <li>c. the availability of appropriate access to all required work areas</li> </ul>	<ul style="list-style-type: none"> <li>d. the inspection of existing domestic hot water/heating system installations</li> <li>e. the availability of a suitable electrical input service</li> <li>f. the proposed siting of key internal system components</li> <li>g. the suitability of the building structure in relation to the proposed installation</li> <li>h. the suitability of the proposed location and position of the solar collector panel(s) ...</li> </ul>
1.2 ... for optimum collection capacity	
<ul style="list-style-type: none"> <li>a. the suitability of the building fabric in relation to the installation of the solar collector panel(s)</li> </ul>	
1.3 Confirm that the tools, materials and equipment required for the installation work are available and are in a safe, usable condition	

<b>Learning Outcome 2</b>								
2. Install solar thermal hot water system components								
<b>Assessment Criteria</b>								
<p>2.1 Install in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures, key system components on either a fully-filled or drainback, ‘active’ solar thermal hot water system to include as a minimum the positioning, fixing and connection of the following components:</p> <p>Fully-filled systems:</p> <table border="0"> <tr> <td>a. solar collector</td> <td>c. solar circulating pump</td> </tr> <tr> <td>b. expansion vessel</td> <td></td> </tr> </table> <p>Drainback systems:</p> <table border="0"> <tr> <td>a. solar collector</td> <td>c. solar circulating pump</td> </tr> <tr> <td>b. drainback vessel</td> <td></td> </tr> </table>	a. solar collector	c. solar circulating pump	b. expansion vessel		a. solar collector	c. solar circulating pump	b. drainback vessel	
a. solar collector	c. solar circulating pump							
b. expansion vessel								
a. solar collector	c. solar circulating pump							
b. drainback vessel								

<b>Learning Outcome 3</b>												
3. Test and commission an ‘active’ solar thermal hot water system												
<b>Assessment Criteria</b>												
<p>3.1 Prepare a fully-filled or drainback solar thermal hot water system for testing and commissioning to include checks/actions to confirm:</p> <table border="0"> <tr> <td>a. compliance with the system design and specification</td> <td>d. correct flushing the system of installation debris</td> </tr> <tr> <td>b. compliance with system/component manufacturer requirements</td> <td>e. correct filling and venting the hydraulic circuits</td> </tr> <tr> <td>c. the suitability of electrical supply circuit arrangements</td> <td>f. protection of the system against freezing</td> </tr> <tr> <td></td> <td>g. adequate provision of system labeling</td> </tr> </table> <p>3.2 Test the system for hydraulic soundness using appropriate test equipment in accordance with manufacturer’s guidance, regulatory requirements and industry recognised procedures</p> <p>3.3 Identify the commissioning requirements for the installation in relation to:</p> <table border="0"> <tr> <td>a. the system/component manufacturer(s) requirements</td> <td>c. the client/end user requirements</td> </tr> <tr> <td>b. system design/specification requirements</td> <td>d. statutory regulations and/or industry recognised procedures</td> </tr> </table> <p>3.4 Commission a fully-filled or drainback system in accordance with manufacturer’s guidance, design requirements, client's requirements and statutory requirements and/or industry recognised procedures</p> <p>3.5 Complete relevant documentation to record the commissioning activities</p>	a. compliance with the system design and specification	d. correct flushing the system of installation debris	b. compliance with system/component manufacturer requirements	e. correct filling and venting the hydraulic circuits	c. the suitability of electrical supply circuit arrangements	f. protection of the system against freezing		g. adequate provision of system labeling	a. the system/component manufacturer(s) requirements	c. the client/end user requirements	b. system design/specification requirements	d. statutory regulations and/or industry recognised procedures
a. compliance with the system design and specification	d. correct flushing the system of installation debris											
b. compliance with system/component manufacturer requirements	e. correct filling and venting the hydraulic circuits											
c. the suitability of electrical supply circuit arrangements	f. protection of the system against freezing											
	g. adequate provision of system labeling											
a. the system/component manufacturer(s) requirements	c. the client/end user requirements											
b. system design/specification requirements	d. statutory regulations and/or industry recognised procedures											

#### **Learning Outcome 4**

4. Handover an 'active' solar thermal hot water system

#### **Assessment Criteria**

- 4.1 Undertake relevant checks to ensure that the system is ready for handover and compliant with manufacturer's guidance, the system design/specification, client's requirements, regulatory requirements and/or industry recognised requirements
- 4.2 Explain and demonstrate to the end user the operation and use of the system using manufacturer's guidance and industry agreed handover procedures
- 4.3 Identify and explain to the end user any aspects of the system that varies from the agreed specifications and requirements
- 4.4 Obtain acceptance by the end user of the system according to the industry agreed handover procedures
- 4.5 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



## Y/602/3104 - Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems

The unit focuses upon the knowledge required to inspect, service and maintain fully-filled and drainback 'active' solar thermal hot water systems. The unit covers systems for domestic hot water production only. The unit focuses upon systems with up to 20m<sup>2</sup> of solar collector area. Upon completion of the unit the learner will:

- Know the requirements for the routine service and maintenance of 'active' solar thermal hot water systems
- Know how to diagnose faults in 'active' solar thermal hot water system installations
- Know how to rectify faults in 'active' solar thermal hot water systems

Learning Outcome 1				
1. Know the requirements for the routine service and maintenance of 'active' solar thermal hot water systems				
Assessment Criteria				
1.1 Confirm which documentation needs to be available to enable routine service and maintenance work on 'active' solar thermal hot water systems				
1.2 Confirm the typical routine service and maintenance requirements for fully filled systems in relation to: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">a. visual inspection requirements</td> <td style="width: 50%;">c. checking of system water content</td> </tr> <tr> <td>b. cleaning of components</td> <td>d. functional tests</td> </tr> </table>	a. visual inspection requirements	c. checking of system water content	b. cleaning of components	d. functional tests
a. visual inspection requirements	c. checking of system water content			
b. cleaning of components	d. functional tests			
1.3 Confirm the typical routine service and maintenance requirements for drainback systems in relation to: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">a. visual inspection requirements</td> <td style="width: 50%;">c. checking of system water content</td> </tr> <tr> <td>b. cleaning of components</td> <td>d. functional tests</td> </tr> </table>	a. visual inspection requirements	c. checking of system water content	b. cleaning of components	d. functional tests
a. visual inspection requirements	c. checking of system water content			
b. cleaning of components	d. functional tests			
1.4 Confirm the industry requirements for the recording and reporting of routine service and maintenance work on solar thermal hot water systems				

<b>Learning Outcome 2</b>	
2. Know how to diagnose faults in 'active' solar thermal hot water system installations	
<b>Assessment Criteria</b>	
2.1 Confirm 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:	
a. loss of system pressure without evidence of discharge	d. overheating of solar collector circuit
b. discharge from pressure relief valve on the solar primary circuit	e. lack of circulation within the solar collector circuit
c. insulation melting on solar collector circuit pipework	f. poor or no system performance
	g. system noise and/or vibration

<b>Learning Outcome 3</b>	
3. Know how to rectify faults in 'active' solar thermal hot water systems	
<b>Assessment Criteria</b>	
3.1 Confirm the work action and sequences required to rectify the following faults:	
a. loss of system pressure without evidence of discharge	e. lack of circulation within the solar collector circuit
b. evidence of discharge valve on the solar primary circuit	f. poor or no system performance
c. insulation melting on solar collector circuit pipework	g. system noise and/or vibration
d. overheating of solar collector circuit	

## K/602/3107 - Inspect, service and maintain 'active' solar thermal hot water systems

The unit focuses upon the occupational competence required to inspect, service and maintain 'active' fully-filled and drainback solar thermal hot water systems. The unit covers systems for domestic hot water production only. The unit focuses upon systems with up to 20m<sup>2</sup> of solar collector area. On completion of the unit the learner will:

- Undertake the routine service and maintenance of an 'active' solar thermal hot water system
- Undertake fault diagnosis work on 'active' solar thermal hot water system installations
- Undertake fault rectification work on 'active' solar thermal hot water system installations

Learning Outcome 1
1. Undertake the routine service and maintenance of an 'active' solar thermal hot water system
Assessment Criteria
1.1 Obtain the relevant information required to enable the work
1.2 Undertake a visual service and maintenance inspection of a fully-filled or drainback, 'active' solar thermal hot water system installation to include checks in relation to: <ul style="list-style-type: none"> <li>a. compliance with manufacturer's installation instructions</li> <li>b. compliance with statutory regulations</li> <li>c. condition of system components including cleanliness</li> <li>d. correct positioning of system components</li> <li>e. security of fixing of system components</li> </ul>
1.3 Undertake routine servicing of relevant components on a fully-filled or drainback, 'active' solar thermal hot water system to include: <ul style="list-style-type: none"> <li>a. checking the system water levels</li> <li>b. checking provision for the expansion of system water</li> <li>c. checking for protection of the system water against freezing</li> <li>d. cleaning of system components</li> <li>e. adjustment of system controls</li> </ul>
1.4 Undertake routine service and maintenance functional tests on a fully-filled or drainback solar thermal hot water system to confirm: <ul style="list-style-type: none"> <li>a. safe operation</li> <li>b. efficient operation</li> <li>c. the correct functioning of system components/controls</li> </ul>
1.5 Complete the relevant service and maintenance records in accordance with industry recognised procedures

<b>Learning Outcome 2</b>								
2. Undertake fault diagnosis work on 'active' so thermal hot water system installations								
<b>Assessment Criteria</b>								
<p>2.1 Obtain the relevant information required to enable the fault diagnosis work</p> <p>2.2 Identify the cause of a minimum of FOUR separate faults from the following list:</p> <table border="0"> <tr> <td>a. loss of system pressure without evidence of discharge</td> <td>d. overheating of solar collector circuit</td> </tr> <tr> <td>b. discharge from pressure relief valve on the solar primary circuit</td> <td>e. lack of circulation within the solar collector circuit</td> </tr> <tr> <td>c. insulation melting on solar collector circuit pipework</td> <td>f. poor or no system performance</td> </tr> <tr> <td></td> <td>g. system noise and/or vibration</td> </tr> </table> <p>2.3 Agree with the relevant person(s) fault rectification procedures for the faults identified</p>	a. loss of system pressure without evidence of discharge	d. overheating of solar collector circuit	b. discharge from pressure relief valve on the solar primary circuit	e. lack of circulation within the solar collector circuit	c. insulation melting on solar collector circuit pipework	f. poor or no system performance		g. system noise and/or vibration
a. loss of system pressure without evidence of discharge	d. overheating of solar collector circuit							
b. discharge from pressure relief valve on the solar primary circuit	e. lack of circulation within the solar collector circuit							
c. insulation melting on solar collector circuit pipework	f. poor or no system performance							
	g. system noise and/or vibration							

<b>Learning Outcome 3</b>								
3. Undertake fault rectification work on 'active' solar thermal hot water system installations								
<b>Assessment Criteria</b>								
<p>3.1 Obtain the relevant information required to enable the fault rectification work</p> <p>3.2 Take relevant precautionary actions to prevent unauthorised use of the system prior to or during the fault rectification work</p> <p>3.3 Take relevant precautionary actions to minimise the risk of injury to self or others during the fault rectification work</p> <p>3.4 Rectify a minimum of TWO separate faults from the following list:</p> <table border="0"> <tr> <td>a. loss of system pressure without evidence of discharge</td> <td>d. overheating of solar collector circuit</td> </tr> <tr> <td>b. discharge from pressure relief valve on the solar primary circuit</td> <td>e. lack of circulation within the solar collector circuit</td> </tr> <tr> <td>c. insulation melting on solar collector circuit pipework</td> <td>f. poor or no system performance</td> </tr> <tr> <td></td> <td>g. system noise and/or vibration</td> </tr> </table> <p>3.4 Undertake post-rectification functional 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</p>	a. loss of system pressure without evidence of discharge	d. overheating of solar collector circuit	b. discharge from pressure relief valve on the solar primary circuit	e. lack of circulation within the solar collector circuit	c. insulation melting on solar collector circuit pipework	f. poor or no system performance		g. system noise and/or vibration
a. loss of system pressure without evidence of discharge	d. overheating of solar collector circuit							
b. discharge from pressure relief valve on the solar primary circuit	e. lack of circulation within the solar collector circuit							
c. insulation melting on solar collector circuit pipework	f. poor or no system performance							
	g. system noise and/or vibration							

## Assessment of Requirements for Individual Units

### Unit Ref: K/602/3138 Understand the Fundamental Principles and Requirements of Environmental Technology Systems BPEC EVTSST-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: F/602/3100 Know the requirements to install, commission and handover solar thermal hot water systems BPEC EVTSST-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: L/602/3102 Install, commission and handover 'active' solar thermal hot water systems BPEC EVTSST-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 EVTSST-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: Y/602/3104 Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems BPEC EVTSST-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).

### Unit Ref: K/602/3107 Inspect, service and maintain 'active' solar thermal hot water systems BPEC EVTSST-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 EVTSST-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 Solar Thermal Hot Water 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 + 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:

- EVTSST-03 – Install, commission and handover 'active' solar thermal hot water systems
- EVTSST-05 – Inspect, service and maintain 'active' solar thermal hot water systems

### Marking 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 knowledge assessment. The knowledge assessments (and supporting rationale) are provided by BPEC Certification Ltd.

- EVTSST-01 – Understand the Fundamental Principles and Requirements of Environmental Technology Systems
- EVTSST-02 – Know the requirements to install, commission and handover solar thermal hot water systems
- EVTSST-04 – Know the requirements to inspect, service and maintain 'active' solar thermal hot water systems

\*The completed knowledge assessment papers (questions and answers) must be retained in the centre portfolio – **KNOWLEDGE ASSESSMENT QUESTIONS AND ANSWERS MUST NOT BE RETAINED IN THE LEARNER PORTFOLIO**

## Marking Knowledge Assessments

The pass rate for the knowledge assessments is 100%

### On line exam

1. The learner will complete the first attempt on line
2. If the learner does not achieve the 100% pass mark, they will be given a second on line attempt at answering any questions answered incorrectly on the first attempt
3. Oral Verification - providing a level of achievement of 80% has been attained, the learner will be orally questioned in an attempt to establish competence in all remaining areas
4. Learners who have not achieved the 80% pass mark after their second attempt will be deemed to have failed the knowledge assessment. Learners wishing to retake the assessment will be required to re-attempt the full theory exam in its entirety

### Learner Result Form

A Learner Result Form has been produced for the Level 3 Award in the Installation and Maintenance of Solar Thermal Hot Water 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. 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
Previous qualifications	✓	✓
Learner result form	✓	✓
Evidence collected e.g. work records, evidence forms	✓	
Knowledge assessment documentation		✓
Performance assessment documentation (contained in qualification assessment manual)	✓	✓

## 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 [A0admin@bpec.org.uk](mailto:A0admin@bpec.org.uk) W [www.bpec.org.uk](http://www.bpec.org.uk)

### Annex 1 - Funding

BPEC Certification Ltd. does not provide details on funding as this may vary between regions. Centres should contact the appropriate funding body to check eligibility for funding and any regional/national arrangements which may apply to the centre or learners.

For funding regulatory purposes, learners should not be entered for a qualification of the same type, level and content as that of a qualification they already hold. Please see below for where to find out more about the funding arrangements.

#### England

Skills Funding Agency  
Cheylesmore House  
Quinton Road  
Coventry  
CV1 2WT

Email: [qualifications@sfa.bis.gov.uk](mailto:qualifications@sfa.bis.gov.uk)

<https://www.gov.uk/government/collections/qualifications-approved-for-public-funding>

<http://data.gov.uk/dataset/learning-aim-reference-service>

#### Northern Ireland

Please contact the Department for Employment and Learning at [www.delni.gov.uk](http://www.delni.gov.uk)

#### Scotland

Colleges should contact the Scottish Further Education Funding Council, at [www.sfc.ac.uk](http://www.sfc.ac.uk)

Training providers should contact Scottish Enterprise at [www.scottish-enterprise.com](http://www.scottish-enterprise.com) or one of the Local Enterprise Companies.

#### Wales

Centres should contact the department for education, lifelong learning and skills: [www.new.wales.gov.uk](http://www.new.wales.gov.uk)

### Annex 2 – 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)