REGULATED QUALIFICATION FRAMEWORK (RQF)

QUALIFICATION SPECIFICATION

LCL Level 3 Awards in the Installation & Maintenance of Solar Thermal Hot Water Systems.

1.0 Qualification Objectives

The objectives of the qualification are to:

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

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

On application for the qualification, the Approved Centre (AC) will carry out an Initial Assessment of the learner's capability to complete the qualification.

Learners holding a level 2 or 3 vocational qualification in the Building Engineering Service (BES) Sector which include the current Water Regulations/Water Byelaws, Hot Water Systems & Safety AD G3 (inc. Unvented Hot Water) and Energy Efficiency for Domestic Heating will confirm their capability to complete the qualification.

Learners not holding the qualification(s) above, will be required to provide evidence to the AC of an alternative suitable qualifications and or provide confirmation of their related work experience and skills.

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

None.

4.0 Qualification Framework

The qualification comprises of 4 mandatory Units which must be satisfactorily completed by learners.

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Unit Title	Unit Reference Number	Type of Unit	Level	Credit Value
Know the requirements to install, commission and handover solar thermal hot water systems.	LCL-R3030	Knowledge	3	1
Install, commission and handover solar thermal hot water systems.	LCL-R3032	Performance	3	1
Know the requirements to inspect, service and maintain solar thermal hot water systems.	LCL-R3033	Knowledge	3	1
Inspect, service and maintain solar thermal hot water systems.	LCL-R3031	Performance	3	1

4.1 Qualification Time and Credit Value

- Total Qualification Time (TQT) is 35 hours
- The Guided Learning Hours (GLH) are 28
- The total credit value of the qualification is 4.

4.2 Qualification Level

The qualification has been assigned at level 3.

4.3 Grading Structure

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

This qualification will be achieved when learners have successfully completed:

- The LCL Awards set and AC marked multiple choice and short response knowledge examinations
- The LCL Awards set and AC marked performance assessments.

4.4 Assessment Methods

The assessment methods within the qualification include multiple choice and short response knowledge examinations and an AC marked performance assessment.

The assessment methods have been designed to assess the knowledge, understanding and skills of learners.

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

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

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

Unit Learning Outcomes and Assessment Criteria

LCL-R3030: Know the requirements to install, commission and handover solar thermal hot water systems.

Learning Outcome 01: The learner will know the health and safety risks and safe systems of work associated with solar thermal hot water systems installation work.

The learner will demonstrate knowledge of:

1.1 Which aspects of solar thermal hot water system installation work pose risk of:
- Electrocution/electric shock
- Burns
- Toxic poisoning
- Injury through flash to steam of system heat transfer fluid
- A fall from height
- Personal injury though component/equipment handling.

1.2 Safe systems of work for solar thermal hot water system installation work in relation to prevention of:
- Electrocution/electric shock
- Burns
- Toxic poisoning
- Injury through flash to steam of system heat transfer fluid
- A fall from height
- Personal injury though component/equipment handling.

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

The learner will demonstrate knowledge of:

2.1 Building regulation/building standards guidance documentation as relevant to solar thermal hot water system installation work to identify the requirements in relation to:
- Maintaining the structural integrity of the building
- Maintaining the fire resistant integrity of the building
- The prevention of moisture ingress (building water tightness)

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- Notification of work requirements
- Control of temperature in primary and secondary circuits; Including primary circuits connected to unvented hot water storage systems
- Energy conservation
- Testing and commissioning requirements
- Compliance certification

2.2 Industry recognised water regulation/byelaw guidance documentation as relevant to solar thermal hot water system installation work to identify the requirements in relation to:

- Prevention of contamination of the wholesome water supply
- Energy conservation
- Safe operation
- Testing and commissioning requirements.

Learning Outcome 03: The learner will know the types and layouts of solar thermal hot water system.

The learner will demonstrate knowledge of:

2.1 Solar thermal hot water systems types:

- Fully filled (active)
- Drain-back (active)
- Passive (thermosiphon).

2.2 Solar thermal hot water system storage vessel types and collector circuit arrangements:

- Direct (fully filled) DHW storage cylinder only
- Indirect, sealed collector circuit, DHW storage cylinder only (solar primary coil only)
- Indirect, sealed collector circuit, DHW storage cylinder only (dual coil)
- Indirect, sealed collector circuit, pre-heat cylinder and DHW storage cylinder
- Indirect, sealed collector circuit, thermal store.

Learning Outcome 04: The learner will know the purpose of components used with solar thermal hot water system installations.

The learner will demonstrate knowledge of:

4.1 The purpose of the following solar thermal hot water system components:

- Differential temperature controller
- Cylinder sensor(s)
- Solar collector sensor
- Drain back vessel
- Flow meter
- Flow regulator (mechanical)
- Expansion vessel.

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Learning Outcome 05: The learner will know the types and key operating principles of solar collectors.

The learner will demonstrate knowledge of:

5.1 The types of solar collector:
- Unglazed collector
- Flat plate glazed collector
- Roof integrated glazed collector
- Evacuated tube collector – direct flow
- Evacuated tube collector – heat pipe

5.2 The key operating principles for:
- Flat plate collectors
- Evacuated tube collector – direct flow
- Evacuated tube collector – heat pipe

5.3 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:
- Unglazed collector
- Flat plate glazed collector
- Evacuated tube collector

Learning Outcome 06: The learner will know the information requirements to enable system component selection and sizing.

The learner will demonstrate knowledge of:

6.1 The information requirements in relation to:
- Building design
- Building dimensions/angles
- Building location and orientation
- Building fabric/material details
- Existing input services
- Existing hot water/heating systems

6.2 The information requirements in relation to:
- Building occupancy
- Required hot water usage pattern

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Learning Outcome 07: The learner will know the fundamental techniques used to select, size and position components for solar thermal hot water systems.

The learner will demonstrate knowledge of:

7.1 How to determine typical domestic hot water system storage vessel requirements in relation to:
- Daily demand (Vd) (litres/day per person or litres/day per m^2 of floor area)
- Boiler volume (Vb)
- Dedicated solar volume (Vs) (litres per m^2 of collector area or as a % or Vd)
- Total cylinder volume (Vt)
- Solar heat exchange coil surface area (m^2 of surface area in relation to collector flow rate and collector surface area)

7.2 How to determine typical domestic hot water system collector area requirements in relation to:
- Building occupancy
- Proposed angle of collector installation
- Proposed orientation of collector installation
- Shading that may affect collector performance

7.3 How to determine the annual irradiation yield as a % of optimum in relation to:
- Collector orientation
- Collector angle
- Collector over shading

7.4 Typical recommended solar primary circuit circulation rates

7.5 How to determine solar primary circuit pipe size requirements in relation to:
- Primary circuit circulation rates
- Collector area
- Primary circuit pipe work length

7.6 How to determine total solar primary circuit water content volume

7.7 How to determine total solar primary circuit expansion vessel size requirements in relation to:
- Primary circuit water content volume
- Collector height above cylinder

7.8 Typical sizing requirements for drain-back vessels in relation to:
- Net collector area
- Total volume of the system

7.9 How to determine solar primary circuit dynamic pressure drop and circulating pump size requirements for:
- Fully filled systems
- Drain back systems

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Learning Outcome 08: The learner will know how the performance of solar hot water systems is measured.

The learner will demonstrate knowledge of:

8.1 The meaning of the term 'solar fraction'
8.2 Factors that affect the solar fraction

Learning Outcome 09: The learner will know the preparatory work required for solar thermal hot water system installation work.

The learner will demonstrate knowledge of:

9.1 The requirements in relation to:
- Authorisation for the work to proceed
- The availability of appropriate access to all required work areas

9.2 The requirements of pre-installation checks in relation to:
- The suitability of the proposed location and position of the solar collector(s) for optimum collection capacity
- The suitability of the building structure and the building fabric in relation to the installation of system components
- Verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system energy load and usage
- The inspection of existing hot water/heating system installations
- Water quality
- The availability of a suitable electrical input service
- The proposed sighting of key internal system components

Learning Outcome 10: The learner will know the requirements for connecting solar thermal hot water system collector circuits to combination boiler domestic hot water circuits.

The learner will demonstrate knowledge of:

10.1 How to determine the suitability of combination boilers to receive pre-heated water
10.2 The pipe work layout and components required for connecting a solar thermal hot water system to a combination boiler to include:
- The arrangements for prevention of backflow
- The arrangements for ensuring that the combination boiler cold inlet supply water is provided at an appropriate temperature
- The arrangements for allowing stored hot water to be used directly from the store when the temperature of the stored water is appropriate

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Learning Outcome 11: The learner will know the requirements for installing solar collector arrays.

The learner will demonstrate knowledge of:

11.1 The positioning and fixing requirements and where appropriate the weathering requirements for the following solar collector types:
- Flat plate, surface mounted, inclined roof with single lap roof covering
- Flat plate, surface mounted, inclined roof with double lap roof covering
- Flat plate, integrated, inclined single lap roof covering
- Flat plate, integrated, inclined double lap roof covering
- Evacuated tube, inclined single lap roof covering
- Evacuated tube, inclined double lap roof covering
- Frame mounted, inclined (roof, wall or ground)
- Frame mounted, horizontal (roof or ground)

11.2 The pipe work layout, component requirements and component positioning requirements for the following system types and collector array connection arrangements:
- Fully filled system, collector array connected in series
- Fully filled system, collector array connected in parallel
- Fully filled system, collector array connected with east/west split
- Drain back system, single collector array.

11.3 The requirements to achieve durable weather-tightness of buildings where collector array connection pipe work passes through the building fabric

11.4 When specialist equipment is required in relation to preventing irradiation reaching collector absorbers during installation

Learning Outcome 12: The learner will know the requirements for installing for solar thermal hot water system pipe work.

The learner will demonstrate knowledge of:

12.1 Suitable pipe work materials in relation to:
- System operating temperatures
- System operating pressures
- System chemicals

12.2 The requirements for pipe work supports in relation to:
- Suitable materials
- Spacing of pipe work supports

12.3 Suitable pipe work jointing methods in relation to:
- System operating temperatures
- System operating pressures
- System chemicals

12.4 System installation work in relation to:
- System operating temperatures

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- System efficiency and performance
- Potential exposure of the insulation to ultra-violet rays/light
- Potential exposure of the insulation to adverse weather
- The sections of installations that must be insulated
- The sections of installations that must not be insulated
- Resistance to vermin attack

12.5 The requirements for installing pressure relief valve discharge pipe work in relation to:

- Routing of pipe work
- Termination of pipe work

Learning Outcome 13: The learner will know the requirements to test and commission solar thermal hot water system installations.

The learner will demonstrate knowledge of:

13.1 The requirements to prepare for testing and commissioning in relation to:

- Compliance with the system design and specification
- Compliance with system/component manufacturer requirements
- Suitability of electrical supply circuit arrangements
- Flushing the system of installation debris
- Selection of suitable heat transfer fluid
- Filling and venting the hydraulic circuits
- Checking system water quality
- Protection against freezing
- Provision of system labelling

13.2 What specialist equipment is required in relation to:

- The introduction and checking of system freeze protection fluids
- Setting system pressure
- Checking the corrosion protection of the system

13.3 The testing requirements for hydraulic circuits within solar thermal hot water system installations in relation to:

- Hydraulic test pressure
- Hydraulic test duration

13.4 The commissioning requirements for a fully-filled indirect sealed collector circuit installation in relation to:

- Setting of the expansion vessel charge pressure
- Setting of the system fluid level
- Setting of mechanical controls
- Setting of electrical controls and
- Temperature sensors
- System functional tests

13.5 The commissioning requirements for a fully-filled drain-back installation in relation to:

- Setting of the system fluid level
- Setting of mechanical controls
- Setting of electrical controls and

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- Temperature sensors
- System functional tests

13.6 The commissioning requirements for multiple collector arrays connected in series

13.7 The recording requirements for the commissioning of solar thermal hot water system installations

Learning Outcome 14: The learner will know the requirements to handover solar thermal hot water systems.

The learner will demonstrate knowledge of:

14.1 The pre-handover checks that need to be carried out

14.2 The industry handover procedures in relation to the:

- Provision of written information
- Provision of diagrammatic information
- Provision of verbal information/demonstration relating to system operation and use

LCL-R3032: **Install, Commission and Handover Active' Solar Thermal Hot Water Systems.**

Learning Outcome 01: The learner will be able to plan and prepare for the installation of 'active' solar thermal hot water system.

The learner will be able to:

1.1 Undertake pre-installation checks for a solar hot water system installation to include checks relating to:

- Authorisation for the work to proceed
- Verification that the generation capacity of the proposed solar hot water system installation is appropriate to the hot water system load
- The availability of appropriate access to all required work areas
- The inspection of existing domestic hot water/heating system installations
- The availability of a suitable electrical input service
- The proposed siting of key internal system components
- The suitability of the building structure in relation to the proposed installation
- The suitability of the proposed location and position of the solar collector panel(s)

1.2 For optimum collection capacity:

- The suitability of the building fabric in relation to the installation of the solar collector panel(s)

1.3 Confirm that the tools, materials and equipment required for the installation work are available and are in a safe, usable condition.

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Learning Outcome 02: The learner will be able to install solar thermal hot water system components.

The learner will be able to:

2.1 Install system components in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures, key system components on either a fully-filled or drain-back, 'active' solar thermal hot water system to include as a minimum the positioning, fixing and connection of the following components:

- Fully-filled systems:
    - Solar collector
    - Expansion vessel
    - Solar circulating pump
- Drain-back systems:
    - Solar collector
    - Drain-back vessel
    - Solar circulating pump

Learning Outcome 03: The learner will be able to inspect and test 'active' solar thermal hot water system components.

The learner will be able to:

3.1 Prepare a fully-filled or drain-back solar thermal hot water system for testing and commissioning to include checks/actions to confirm:

- Compliance with the system design and specification
- Compliance with system/component manufacturer requirements
- The suitability of electrical supply circuit arrangements
- Correct flushing the system of installation debris
- Correct filling and venting the hydraulic circuits
- Protection of the system against freezing
- Adequate provision of system labelling

3.2 Test the system for hydraulic soundness using appropriate test equipment in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures

3.3 Carry out the commissioning requirements for the installation in relation to:

- The system/component manufacturer(s) requirements
- System design/specification requirements
- The client/end user requirements
- Statutory regulations and/or industry recognised procedures

3.4 Commission a fully-filled or drain-back system in accordance with manufacturer's guidance, design requirements, client's requirements and statutory requirements and/or industry recognised procedures

3.5 Complete relevant documentation to record the commissioning activities

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Learning Outcome 04: The learner will be able to inspect and test 'active' solar thermal hot water system components.

The learner will be able to:

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

LCL-R3033: Know the Requirements to Inspect, Service and Maintain 'Active' Solar Thermal Hot Water Systems.

Learning Outcome 01: The learner will be able to inspect and test 'active' solar thermal hot water system components.

The learner will be able to:

1.1 Select the documentation which needs to be available to enable routine service and maintenance work on 'active' solar thermal hot water systems
1.2 Carry out the routine service and maintenance of a fully filled system in relation to:
- Visual inspection requirements
- Cleaning of components
- Checking of system water content
- Functional tests

1.3 Carry out the routine service and maintenance of a drain back system in relation to:
- Visual inspection requirements
- Cleaning of components
- Checking of system water content
- Functional tests

1.4 Comply with the industry requirements for the recording and reporting of routine service and maintenance work on solar thermal hot water systems

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Learning Outcome 02: The learner will know how to diagnose faults in 'active' solar thermal hot water system installations.

The learner will demonstrate knowledge of:

2.1 The information that needs to be available to enable fault diagnosis
2.2 The work action and sequences required to diagnose the following faults:
- Loss of system pressure without evidence of discharge
- Discharge from pressure relief valve on the solar primary circuit
- Insulation melting on solar collector circuit pipework
- Overheating of solar collector circuit
- Lack of circulation within the solar collector circuit
- Poor or no system performance
- System noise and/or vibration.

Learning Outcome 03: The learner will know how to rectify faults in 'active' solar thermal hot water systems.

The learner will demonstrate knowledge of:

3.1 The work action and sequences required to rectify the following faults:
- Loss of system pressure without evidence of discharge
- Discharge from pressure relief valve on the solar primary circuit
- Insulation melting on solar collector circuit pipework
- Overheating of solar collector circuit
- Lack of circulation within the solar collector circuit
- Poor or no system performance
- System noise and/or vibration

LCL-R3031: Inspect, service and maintain solar thermal hot water systems.

Learning Outcome 01: The learner will be able to undertake the routine service and maintenance of an 'active' solar thermal hot water system.

The learner will be able to:

1.1 Obtain the relevant information required to enable the work to be undertaken
1.2 Undertake a visual service and maintenance inspection of a fully filled or drain back, 'active' solar thermal hot water system installation to include checks in relation to:
- Compliance with manufacturer's installation instructions
- Compliance with statutory regulations
- Condition of system components including cleanliness
- Correct positioning of system components
- Security of fixing of system components

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1.3 Undertake routine servicing of relevant components on a fully filled or drain back, 'active' solar thermal hot water system to include:
- Checking the system water levels
- Checking provision for the expansion of system water
- Checking for protection of the system water against freezing
- Cleaning of system components
- Adjustment of system controls

1.4 Undertake routine service and maintenance functional tests on a fully filled or drain back solar thermal hot water system to confirm:
- Safe operation
- Efficient operation
- The correct functioning of system components/controls

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

Learning Outcome 02: The learner will know how to undertake fault diagnosis work on 'active' solar thermal hot water system installations.

The learner will demonstrate knowledge of:

2.1 Obtaining the relevant information required to enable the fault diagnosis work

2.2 Identifying the cause of system faults from the following:
- Loss of system pressure without evidence of discharge
- Discharge from pressure relief valve on the solar primary circuit
- Insulation melting on solar collector circuit pipework
- Overheating of solar collector circuit
- Lack of circulation within the solar collector circuit
- Poor or no system performance
- System noise and/or vibration

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

Learning Outcome 03: The learner will be able to undertake fault rectification work on 'active' solar thermal hot water system installations.

The learner will be able to:

3.1 Obtain the relevant information required to enable the fault rectification work

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

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

3.4 Rectify faults from the following:
- Loss of system pressure without evidence of discharge
- Discharge from pressure relief valve on the solar primary circuit
- Insulation melting on solar collector circuit pipework

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- Overheating of solar collector circuit
- Lack of circulation within the solar collector circuit
- Poor or no system performance
- System noise and/or vibration

3.5 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

6.0 Other Information

Qualification Regulator Numbers:

- Ofqual QAN – 600/7439/5
- Qualifications Wales - C00/0527/3

Sector Skills Area: SSAs: 5.2 Building and Construction.

Age suitability: 16 plus.

Last Qualification Review Date October 2026

Qualification Review Date: 31.10.2029.

Amended October 2026

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